# electrical contracting

SECTION

PAGES 95-106

NOVEMBER • 1940

# ANNOUNCING!

## A MIDGET FLOODLIGHT

that offers you

## NEW EASY PROFITS

**$2.95 LIST PRICE**

HERE'S an inexpensive, lightweight, weatherproof, 100-watt floodlight to serve a multitude of every-night purposes in the home, garden, and garage; around the farm or factory; at roadside stands and real estate displays. Wherever a strong, well diffused, portable light is needed—for convenience or protection, aid to work or business, or after-dark recreation—recommend the new Type L-65 midget handy floodlight.

A floodlight or two around the home eliminates that uncomfortable, uneasy feeling that prowlers are about; a flick of the switch turns darkness into daylight. Think of the variety of ways you could use a small, handy floodlight—that's your market in hundreds of homes. Then too, even the smallest businesses can afford this inexpensive floodlight for lighting the back of a store, window displays, roadside stands, tourist camps.

Plan now for your share of *year-round profits*. The midget handy floodlight lists for only $2.95. Ask your G-E distributor to let you see one. Ask him, too, to show you the attractive display poster and literature designed to help you sell L-65's. Or better yet, order a stock today and be ready for more floodlighting business. General Electric, Schenectady, N. Y.

### EASILY MOVED ABOUT EASILY INSTALLED

Permanent installation on 4-inch outlet box

Base is large enough to hold floodlight upright in any position

### BUILT FOR YEAR-AFTER-YEAR USE

REFLECTOR—Accurately die-formed, sheet-aluminum reflector will not peel, discolor, or deteriorate. Etched surface.

LAMP HOUSING—One-piece aluminum with rubber cable-entrance bushing.

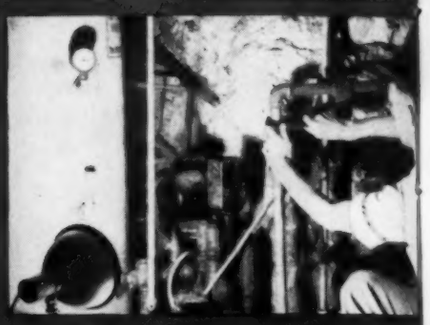
SWIVEL AND BASE—Formed steel with attractive green-paint finish. Wing nuts provide vertical and horizontal adjustment. Base arranged as cover for either 3- or 4-inch outlet box.

DOOR GLASS—Plain, clear, heat-resisting. Cork gasket makes unit weatherproof.

CURRENT-CARRYING CABLE—Six feet of two-conductor, rubber-covered cable with moulded plug.

GENERAL ELECTRIC

### APPLICATION EVERYWHERE



AROUND THE HOME

ON THE FARM

FOR PROTECTION

FOR REAL ESTATE DISPLAY

AT CHRISTMAS

QUICK AS A WINK! SIMPLE AS ABC!

# "Take a tip from me!"

QUICKER, EASIER INSTALLATION

"Jiffy switches, you ought to call 'em," suggests one contractor. "They're up as fast as you look at 'em—an' easy 's rollin' off a log!" Indoor and Outdoor types for installation of one switch or groups of hundreds. Single or dual switches for range and service—with or without branch circuits. Switch units of one-piece Bakelite. Metropolitan Device Corporation, Brooklyn, N. Y.



# Murray

## PULL-OUT TYPE RANGE & SERVICE SWITCHES

METROPOLITAN DEVICE CORPN.
1250 Atlantic Ave.
Brooklyn, N. Y.

Please send information on Murray Pull-Out Type Switches.

Name_____

Company_____

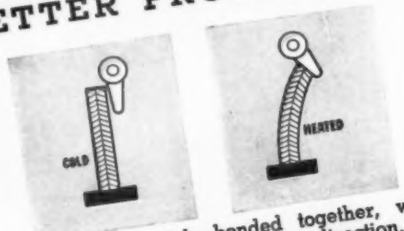
Address_____

# Get Bi-Metal ... and Eliminate

## Ask Your Westinghouse Representative For This Bi-Metal Demonstration

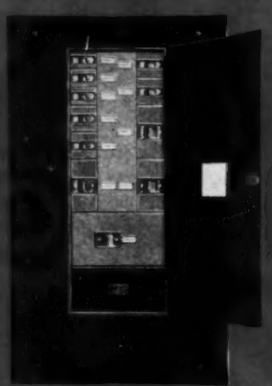
*Make This Test Yourself.*... A strip of Bi-Metal and a match are all you need to prove to yourself the time and moneysaving advantages of Bi-Metal Protection. Ask your Westinghouse Representative for a Bi-Metal Demonstration Kit.

## HERE'S HOW BI-METAL SAVES MONEY... GIVES BETTER PROTECTION

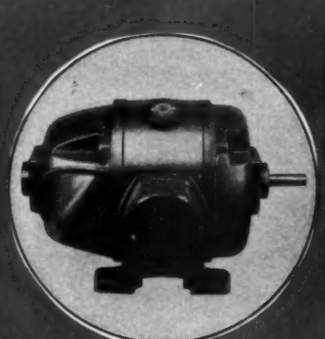



Two different metals bonded together, when heated always bend in the same direction. The heat from short circuit or continued overload currents causes the Bi-Metal, which is exactly calibrated to the job at the factory, to act and open the circuit. Because of Bi-Metal's characteristics, its accuracy never changes, regardless of the number of operations. There's nothing to replace ... nothing to wear out.

## YOU PAY NO MORE FOR BI-METAL PROTECTION IN THIS WESTINGHOUSE EQUIPMENT



**LIGHTING AND POWER PANELBOARDS**
Bi-Metal protects circuits and eliminates fuses. "De-ion" arc quenchers save contacts. Tamper-proof.



**THERMOGUARD MOTOR**
Single-phase sizes up through 2 hp. Impossible to burn out. Bi-Metal gives positive protection at all times.

**"DE-ION" MOTOR WATCHMAN**
Manual motor starter for motors up to 7½ hp. Bi-Metal overload protection. "De-ion" arc quenchers. On-Off-Tripped self indicating.

# Westinghouse

W
WESTINGHOUSE ELECTRIC

# Protection
# *Fuse Replacements*

## NOTHING TO RENEW OR REPLACE WITH *NOFUZE* CIRCUIT BREAKERS

Bi-Metal has changed all ideas about circuit protection. It's no longer necessary to spend time and money for fuse replacements. Westinghouse Nofuze Breakers eliminate fuses and give positive, accurate protection.

Bi-Metal opens the circuit instantly when a dangerous overload or short circuit occurs. To restore the circuit, just move the operating lever to "RESET" and then to "ON" position. There's nothing to renew or replace.

You save outage time . . . save maintenance time . . . save replacement costs. Give your men and machines the safe, accurate protection of Bi-Metal. You get these savings at a cost that is often less than a complete switch and fuses. Specify Westinghouse Nofuze Breakers on your next installation.

### "DE-ION" ARC QUENCHERS AT NO EXTRA COST

Westinghouse "De-ion" arc quenchers confine, divide and extinguish the arc instantly . . . preventing burning and prolonging the life of contacts.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

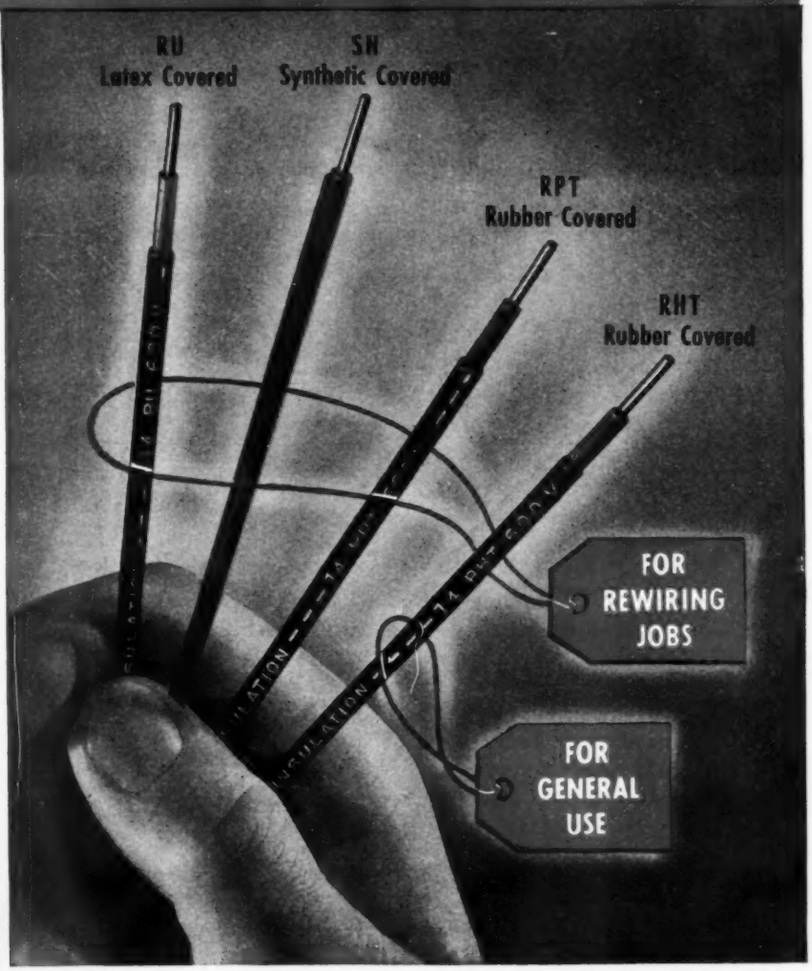
J-90339

NOFUZE CIRCUIT BREAKER—"ON," "OFF" and "TRIPPED" positions clearly visible. Safety interlock prevents cabinet door from being opened when in "ON" position

# Motors and Control

# ALL 4 TYPES!

## Take Your Pick of Roebling SMALL DIAMETER (THIN-WALL INSULATION) BUILDING WIRE




Then get the Roebling Catalog for Permissible *Percent of Conduit Fill—Current Loadings—Operating Temperatures*—and other information you need to estimate new work and rewiring jobs.

**SEND FOR FREE COPY**

Only one person can answer the question—"which type of thin wall insulation is best?"—YOU, the man who knows all the factors of installation, working conditions, and load requirements.

The characteristics of thin wall insulation vary with the type designation. These are:

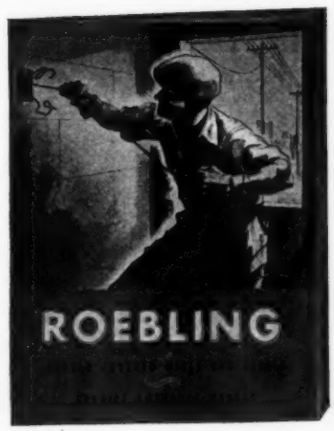
Type RHT—Heat-resistant rubber compound—maximum operating temperature 75°C.
Type RPT—Performance rubber compound—maximum operating temperature 60°C.
Type RU — 85% grainless rubber compound–60°C.
Type SN — Plastic type compound–60°C.

With the exception of SN, these wires are required with a fibrous covering that is moisture-resistant and flame-retardant.

Detailed characteristics of requirements of these types of wires are available in separate standards of the Underwriters' Laboratories, Inc., New York, N. Y. These may be obtained direct or by requesting us for copies.

Roebling *Rubber Covered Wires and Cables—Service Entrance Cable* Catalog will be helpful in the proper selection of wires for your job. It should be on the desk of every man concerned with wiring work. If you haven't a copy be sure to write for it today.

JOHN A. ROEBLING'S SONS COMPANY
Trenton, N.J. Branches in Principal Cities




**Ask for Catalog No. 101**

# ROEBLING SMALL DIAMETER BUILDING WIRE

# electrical contracting

*With which is consolidated The Electragist and Electrical Record*
*Established 1901*



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A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction — industrial, commercial, and residential.


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# You can go 'round with a PUTTER

## BUT...

### YOU'LL NEVER SHOOT PAR

•

*Are You Handicapping Your Business?*

SOME electrical contractors handicap themselves needlessly by not taking full advantage of those helpful, handy little business-builders Anaconda prepared especially to attract new wiring opportunities—the Industrial Wiring Survey and the Industrial Wiring Guide.

Judge for yourself: according to authorities nine out of ten industrial plants today are wasting money and risking electrical failure through hidden power losses—losses arising from old worn-out equipment, overloading and inadequate wiring. Still more important, most plant supervisors need to be told of this condition.

The Industrial Wiring Survey makes it possible for you to offer the firms in your community a step-by-step wiring survey of their plants. The Industrial Wiring Guide tells how to correct the conditions found. Ask your regular Anaconda distributor for your copies of these two sound stepping-stones to bigger wiring profits. They're yours for the asking.

ANACONDA

USE MODERN IMPROVED **Anaconda Wire & Cable**

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electrical contracting

NOVEMBER, 1940

# Our Turn, A Bit

GIOVANNI DELLE BANDE NERE WAS TOP MAN among the condottieri. This was Italy, the 16th Century. He hired his "Black Band" to pope or prince, whoever offered the best pay and wanted to indulge in war. And the side that Giovanni fought for always won. You pointed out your enemy. He sacked the city and put his brother Italians neatly to the sword.

WE DO THINGS DIFFERENTLY NOW, but some of the principles still hold. For example, for our first fifty years the power companies ran the electrical industry with their NELA. They were building the industry and had to keep order and develop our electrical systems soundly. Then came political persecution and cold feet. The manufacturers took over. NEMA is the strong association today, creating markets, standardizing products, fighting for electrical progress.

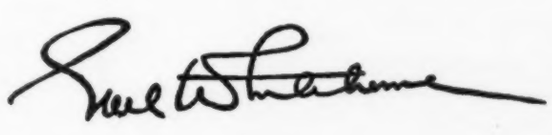
AND NOW COMES THE TIME when rewiring, re-lighting and general modernization is the biggest thing before the electrical industry. And what of our contractor association, which has just held its annual convention in Jacksonville? The story is told on another page—the same sad old story—a splendid program—some excellent objectives —a few hundred there—maybe 15,000 absent and indifferent.

NOW, WE WANT STATEWIDE INSPECTION to insure the safety of electrical construction everywhere. Many power companies oppose it, fearing higher costs. But 10,000 contractors together can present a plan that's in the public interest and sell this idea completely.

WE WANT CONTRACTORS LICENSED EVERYWHERE to insure that only competent men install wiring. The manufacturers oppose this, fearing political control and unfair practice. But 10,000 contractors together can present a plan that's safe and get it done.

WE WANT A SOUND APPRENTICE SYSTEM that will give us competent young wiremen coming along. The unions approve but make conditions too hard. Yet 10,000 contractors together could work this out too.

UNDERSTAND, HOWEVER, THAT IN CITING THESE THREE EXAMPLES, I do not suggest that NECA try to dominate the electrical industry. I do not advocate old Giovanni's methods. But *Sweet Spirits of Nitre!* Why don't we unite our full strength and go after what we want? At least that part of the "Black Band's" system is still good, so long as it is tuned to the public interest.



Wires Cut

Blue Prints Stolen

Sabotage Seen in Factory Fire

Intruder Seized in Aircraft Plant

G-Men Warn Against Unprotected Grounds

# You can help...

## Free Bulletin

**HELPS GET THIS BUSINESS**

This brand new GRAYBAR "Planned Protection Can Meet This Challenge" starts off with a *check list of danger points* that will aid you greatly in convincing industrial plants that they can protect themselves electrically. It tells the fundamentals of floodlight protection for yards, railroad sidings, storage tanks and other areas around the plant. › › › The place of signaling and alarm systems in planned protection is also given, with plenty of sales arguments showing their vital importance in emergencies. In addition, there's a discussion of the need for rewiring to assure an uninterrupted power supply. Write for your free copy today.

**INDUSTRY MEET THIS CHALLENGE**

**...AND *Build New Profits* FROM**

★ LIGHTING

★ SIGNALING

★ WIRING

Industrial plants engaged in defense work are being challenged more and more by dangers like these. Right now, you can help give industry the *planned protection* it needs from intruders and saboteurs. And GRAYBAR is ready to help you profit from this vitally important type of business.

GRAYBAR offers *action-service* on floodlights for outdoor protection and all types of industrial lighting equipment... signaling and intercommunication systems... wiring supplies to meet the exacting standards for "interruption-proof" service. What's more, GRAYBAR specialists are always on call to help you solve unusual problems. Write for bulletin (described at left) right now!

GraybaR QUALITY Since 1869 — *Everything Electrical* — GraybaR ELECTRIC COMPANY

**Executive Offices: Graybar Building, New York**

**GRAYBAR—IN OVER 80 PRINCIPAL CITIES**

# At TIFFANY'S New Building

By August Eckel

Tiffany, famous jewelers of Fifth Avenue have a carefully designed electrical system for their new building in New York City. Long experiment and precise engineering developed a combination of lighting systems most helpful in the display of precious stones and gold and silverware. The installation suggests ideas that can be applied in other commercial and even industrial buildings.

WHENEVER precious stones and jewelry are mentioned the name "Tiffany" flashes to the mind. For Tiffany, for generations has presented the most elaborate and extensive display of diamonds, jewelry, silverware and art objects in gold and bronze to be seen in America. So when Tiffany leaves its beautiful building on lower Fifth Avenue and again moves further uptown, there is wide spread interest to learn how their new building is equipped, what new ideas in the display of jewelry it presents.

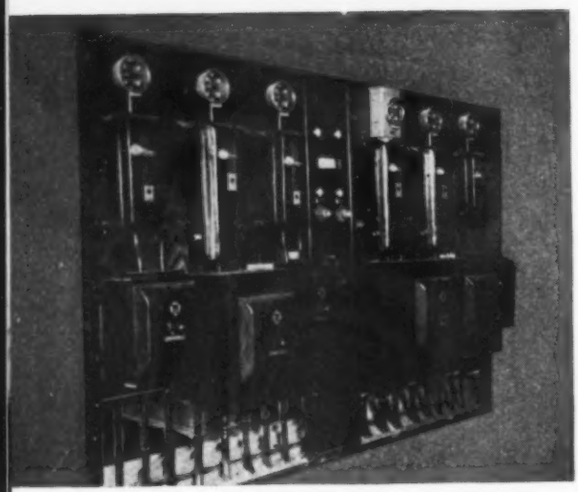
The new building, which they have just opened, is located on the corner of New York City's Fifth Avenue and 57th Street, one of the most fashionable business sections of the great metropolis. Here has been built a most beautiful home for the most beautiful of gems.

The building is striking in its simplicity. It was designed by Cross and Cross, architects and was built by the Turner Construction Company. Consulting engineers were Jaros, Baum and Bolles; consulting electrical engineers, Clifton E. Smith and Edward B. Silverman. The electrical contractor on the job was Lord Electric Company. All of these firms are local.

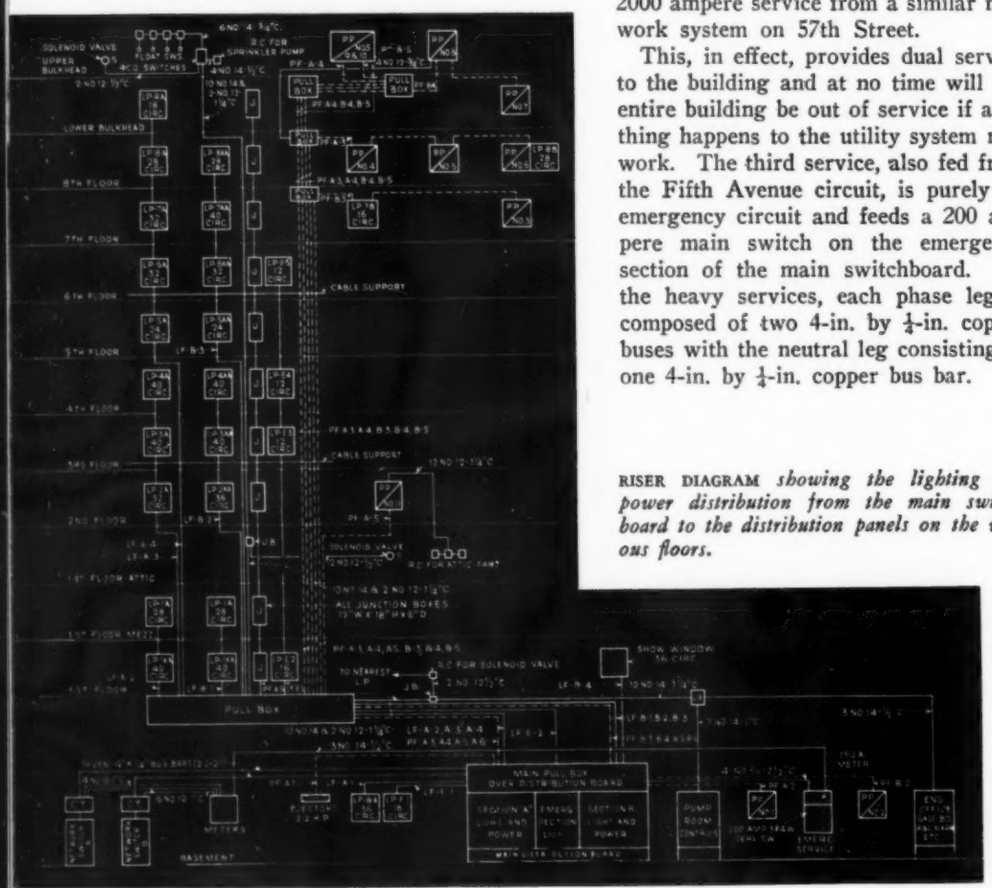
The building is a 7-story, basement, mezzanine and pent house structure and is constructed of granite, limestone and marble. The main sales area on the first floor has a ceiling height of 23 feet and is entirely unobstructed by columns. It contains an eight foot hung ceiling of pre-cast acoustical plaster panels which tend to conceal the lighting louvers, air conditioning grilles and sprinkler heads. The floor area contains numerous show windows, display cases and island show cases. The second and third floors are also devoted to sales and contain numerous display cases of the wall and island types. The remainder of the floors contain the offices, private sales rooms, jewel shops, repair shops, stock rooms and the other necessary branches of the jewelry business.

### The Electrical System

The electrical system in this building is quite extensive and although a good portion of it is devoted to power service, the majority of it supplies the large lighting load. For, in the display and sale of jewels, light is an important factor. So, the engineers devoted a great deal of study and time to the



CONTROL BOARD *for the air conditioning equipment combines motor control with air conditioning control instruments. Note meter sockets for making load tests on motor circuits.*



RISER DIAGRAM *showing the lighting and power distribution from the main switchboard to the distribution panels on the various floors.*

design of the lighting system and specified the installation of several distinct illumination systems and specially designed fixtures to produce the best possible light available. The power system supplies service to the variety of pumps, fans, blowers, compressors, air conditioning equipment, lathes, drill presses, grinders and other machines necessary to the manufacture and repair of jewelry. Almost all the motor controls are of the combination circuit breaker disconnect and magnetic starter type. Those that are not have circuit breaker disconnects in separate enclosures ahead of the motor starter.

### Service Provisions

There are three distinct and separate underground electrical services to the building. They all terminate in one large main distribution panel in the basement switchboard room. The switchboard is divided into three sections. One section carries about one half the total electrical load and is fed by a 2000 ampere, 120/208 volt, 3 phase, 4-wire service from the utility secondary network system on Fifth Avenue. The other section takes the rest of the load and is also fed by a 2000 ampere service from a similar network system on 57th Street.

This, in effect, provides dual service to the building and at no time will the entire building be out of service if anything happens to the utility system network. The third service, also fed from the Fifth Avenue circuit, is purely an emergency circuit and feeds a 200 ampere main switch on the emergency section of the main switchboard. On the heavy services, each phase leg is composed of two 4-in. by $\frac{1}{4}$-in. copper buses with the neutral leg consisting of one 4-in. by $\frac{1}{4}$-in. copper bus bar.

### Distribution System

Electrical distribution is controlled by a main panel which extends practically the full length of the switchboard room. Section A of the board is fed from the Fifth Avenue service through a 2000 ampere circuit breaker and contains thirteen branch breakers from 50 ampere to 600 ampere in size. Section B has the same size main breaker and the board is identical in size. The emergency lighting panel, located between the two large sections of the board, consists of a 225 ampere main breaker, a 200 ampere breaker connected to the automatic transfer switch, one 100 ampere, one 225 ampere branch breaker and a 50 ampere spare. All distribution wiring is with 30 per cent rubber covered wire in galvanized conduits concealed in the slab or hung ceilings.

Power distribution is accomplished by the use of eleven distribution panels located on the various floors and constructed of the dead front safety type with the pull-out fused unit. These panels range in size from four to 20 circuits. All elevator power panels have thermal breakers. Wherever possible, motor controls are grouped, either on a slate panelboard or on an iron rack. All fan and pump motors have socket type meters in the circuits to detect dangerous overload conditions.

The lighting distribution system consists of 18 switch-fuse type distribution panels located on the various floors, with five additional emergency lighting panels fed from the emergency service in the basement. Each of the panels on the first, third and fourth floors is equipped with automatic switches with remote controls on sections of the floor lighting system. The minimum wire size on the branch circuits for lighting and power is No. 12.

Thirty per cent rubber covered wire is used throughout with a lead sheath employed on all wiring for outside work or in floor slabs under which there is no excavation.

### Emerency Lighting System

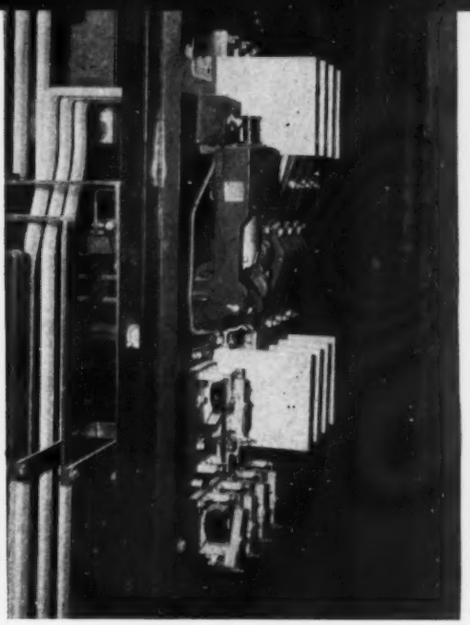
The emergency lighting system consists of five distribution panels located on the various floors and fed from the emergency section of the main switchboard in the basement. The switchboard panel is connected to each of the large sections of the board through a 200 ampere automatic transfer switch. This emergency panel is normally fed from the Fifth Avenue utility service. If by any chance this service should have an outage, the transfer switch will automatically throw the entire emergency lighting load over to section B, which is fed from the 57th Street network system. Each panel is connected to lighting fixtures located in strategic points throughout the building to provide light for seeing and protection during emergency periods.

### The General Lighting

There are three distinct systems of lighting used in this building. The first

CATWALK SERVICING *for the main sales area down lighting is provided in the eight-foot hung ceiling. Access is provided to each of the 188 units in this area.*

MASTER SWITCH *for the sprinkler alarm system gives alarm and actuates sprinkler system in case of fire and indicates the opening and damage to a sprinkler head.*



AUTOMATIC TRANSFER *switch on the back of the emergency lighting panel transfers emergency lighting load from one service to the other in case of outage.*

is the incandescent system of lighting employing direct lens type down lighting for general illumination and show case lighting. Indirect incandescent lighting is used in the office areas and diffused direct lighting in the work areas and stock rooms. The second is the fluorescent system which is used as general lighting in the second and third floor sales areas; as well as for inspection work in the repair areas and for localized lighting in the show cases. The third system is a high voltage fluorescent tube lighting system used in the display cases on the first floor sales area.

Lighting of the first floor of the building combines direct down lighting and indirect urn type lighting for general illumination and direct lens and high voltage tube lighting for the show cases. The general illumination in this area is produced by 188 direct downlight projectors concealed in the eight-foot hung ceiling, 23 feet above the floor. Each projector has a combination of lenses which will correct the light beam, with a minimum loss of light and eliminate chromatic aberrations and discolorations. The lenses are made of crystal which will withstand constant heat without discoloration and the reflectors are provided with a specular finish that has the same properties.

Each projected beam is rectangular in section to conform with the contours of the show cases. All the lenses are enclosed in adjustable metal tubes to facilitate removing, positioning and locking the lens. Green glass filters with vertical and horizontal sight lines are provided at each side of the lamp for sighting the filament to focal position. Each downlight projector uses a 100-watt clear incandescent concentrated filament lamp, and is wired with a short length of armored cable with a lock type plug which fits into a receptacle. These receptacles are mounted in conduit fittings at the lamp position in the hung ceiling. Catwalks are installed in this eight-foot hung ceiling to facilitate servicing the lamps and all other conduit and pipe and duct systems. The lighting intensity on the working plane at the surface of the display cases in the main sales area averages 30 foot-candles.

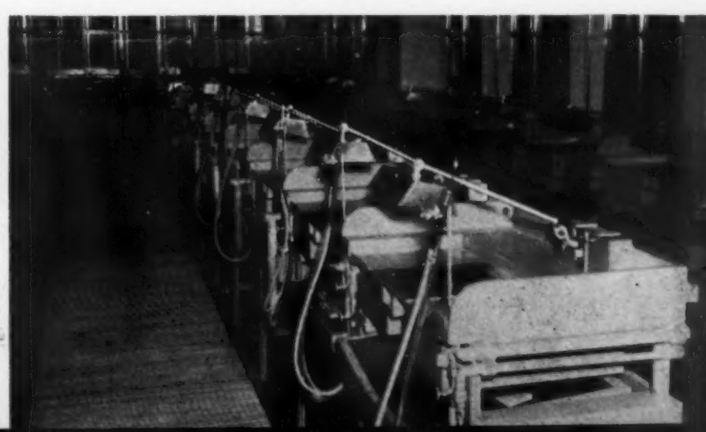
Show window lighting consists of twin fluorescent reflectors with white lamps, tulamp auxiliaries and adjustable brackets combined with flush louvered incandescent units and some spotlights. The high island show cases are each equipped with a huge tub-like trough which fits over the top of the case. This trough contains four 100-watt 6½-in. by 6½-in. direct lens lights to illuminate the merchandise in the case. Also, there are mounted in each of these troughs six 750-watt Bipost T24 lamps, basedown, in totally indirect urn type units which throw a beam of light upwards toward the ceiling. In addition, the upper edges of the case are lined with high voltage fluorescent tubing in metal reflectors. The low type show cases are also equipped with this high voltage tube lighting.

This is a comparatively new type of lighting called Zeon, which employs a combination of neon, argon and other rare gases in a 10 millimeter tube coated with a special fluorescent powder to produce a special white light which will bring out the distinctive colors of all the stones displayed. This lighting operates on a 110-volt circuit

[Continued on page 42]

WIRING TROUGH *for fluorescent fixtures are mounted in the hung ceiling first, then the fixture body with lamp holders, auxiliaries and switches.*

INDIVIDUAL BENCHES *for close work on jewelry are equipped with adjustable fluorescent bracket lamps. Feedrail above supplies current to portable tools.*



# NECA Meets

**Contractors plan better salesmanship, improved statistics, more accurate estimating, urge standardized materials**

TWO-FISTED thinking on industry problems, a forthright recognition of labor's common stake in the future of electrical contracting and evidence of an awakening sales consciousness marked the 38th Annual Convention of the National Electrical Contractors Association held in Jacksonville, Florida, October 20-23. The official attendance figures approached 500 for a new record in recent years.

And from the rostrum able and prominent men from our industry and other agencies close to us followed one another in a thought provoking and informative program. Here are the high spots as the meeting moved ahead.

**MONDAY MORNING**

*McChesney Reviews Progress*

President Robert W. McChesney reviewed what NECA has been doing for its members. He stated that the wisdom of the 1940 arrangement of NECA services into two classes — general benefit and special benefit activities—has been demonstrated in this first year of operation. Touching upon each of the NECA services in turn, he reviewed plans for market development with the new sales manual, asked the help of contractors in providing original data for the estimating and cost data manual. He also reviewed the need for more complete industry statistics, cooperation with other parts of the industry toward standardization and a close guard over legislation affecting the rights and interests of the contractor.

Secretary Laurence W. Davis reported NECA in a healthy financial condition but reduced in membership which was on October 1st, 1265 members.

D. B. Clayton, reporting as head of the Sales Development Committee asked for constructive criticism of the new sales manual. "The customer," he said, can only be properly served when we are able to sell him the proper type of wiring. "We have been waiting for crumbs to drop from the architects table. Industry is now faced with new work and will welcome intelligent assistance from the contractor."

A smart promotion plan for residential wiring sales was presented by Warren Penn of Burbank, California, in his report of the Gold Seal Building Industries Plan of Guaranteed Wiring. With trade marked quality and bonding, each job is guaranteed, he reported. Price lists are published and general contractors are aided by advertising if they buy Gold Seal wiring.

**MONDAY AFTERNOON**

*Dan Tracy Speaks Out*

The I.B.E.W. employers section went into action with a report by Chairman E. C. Carlson, of the Labor Relations Committee. He asked for better understanding through joint local cooperation and a joint national medium for the solution of industrial disputes.

Dan W. Tracy, Assistant Secretary of Labor and chairman of the executive council of I.B.E.W., spoke out for the elimination of industrial disputes at the source, by removing the underlying causes. This nation is engaged in its greatest peacetime defense program, he said, and there is no time for industrial disputes.

The best plan for preserving harmony so far devised was the council on Industrial Relations now operating in the electrical construction industry.

J. Walter Collins bluntly told the industry that good business depends upon a heritage of labor skill and efficiency, in a detailed report on apprenticeship training. All industry, he said, has been concentrating on the problem of unemployment and consequently bringing up no replacements for the men who must, in time, retire.

Collins asked to be relieved of his national activity on apprenticeship

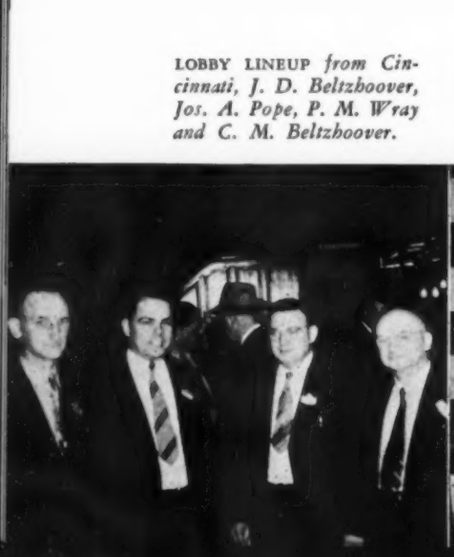
LOBBY LINEUP *from Cincinnati, J. D. Beltzhoover, Jos. A. Pope, P. M. Wray and C. M. Beltzhoover.*

CALL TO ORDER. *Bob McChesney opens the meeting while Larry Davis gets set to report.*

GENIAL SMILE *belongs to Wm. J. Wheeler of The Maintenance Company of New York.*

IBEW PRESIDENT, *Ed Brown was introduced by employer Ed. Herzberg of Milwaukee.*

DIVIDENDS. *Geo. Patterson shows what you get by using the Cost Data Manual.*



# s in JACKSONVILLE

LABOR COORDINATORS *P. M. Geary, Washington and E. C. Carlson, Youngstown.*

CHICAGO LEADER *Wm. McGuineas was among a two carload shipment from that city.*

tractors at a dinner Monday night.

Genial, smiling, Ed Brown, well known to contractors in the Middle West for his business like methods of handling labor problems with contractors, met many of the leading contractors of other parts of the country for the first time at this get-together.

**TUESDAY MORNING**

***Andrae Calls for Standardization***

In his report on the activities of the Codes and Standards Committee, Chairman George Andrae called for the elimination of black pipe and boxes, the use of multiple conductors in 1/0 to 500,000 circular mil sizes to eliminate larger sizes of wire and the elimination of 50 degree and 60 degree insulation in an effort to standardize on 75 degree types. Not one of these efforts toward standardization, he stated, involves a controversial issue, rather, others would welcome the contractors' action.

An ingenious instrument for calculating conduit and wire capacities under all conditions was introduced by Homer G. Knoderer of the General Electric Co. By means of a huge model of the slide rule, he described each step in its operation. The "wirometer", which was distributed to each of the delegates present, is designed to eliminate the need for reference to Code tables in figuring conduit and wire problems.

A review of important changes in the 1940 Code rules regarding branch circuits and feeders was presented by Joseph Whitner, assistant chief engineer of the Southeastern Underwriters Association.

Discussing standardization and simplification, Dr. Morton G. Lloyd, head of the section of safety codes of the Bureau of Standardization, urged interchangeability of electrical devices. Simplification means, he said, limiting the variety to meet regular needs. However, it does not exclude special items but only recognizes them as special.

On Tuesday afternoon, business was temporarily adjourned to allow the golfers a chance at the splendid Ponte Vedra beach course. Non-golfers tried swimming or just basking about in the Florida sunshine.

**WEDNESDAY MORNING**

***Industry Advertising***

George Patterson, head of the cost data committee started the Wednesday morning program with a brief review

training and urged that the work be carried on by the Labor Relations Committee.

He urged the contractors to develop strong local organizations which, acting jointly with strong I.B.E.W. locals, could meet and solve industry problems around the conference table.

New I.B.E.W. President Ed Brown made his bow to the union shop con-

of the new data included in the Cost Data Manual. New tables for overhead calculation, cost of tools, underground distribution systems and transformers have recently been included, he said, and a new set of tables on service entrances are now being prepared. NECA Manual labor units are accurate to within 3 to 5 per cent of actual costs, he stated in closing.

Ray Ashley, research engineer for the Electrical Contractors Association of Chicago, followed with a brilliant study of the comparative costs of electrical construction work by competent electrical contractors and by industrial labor. His paper appears on pages 17-18.

A lively discussion, set off by Bob Goeller of New York, brought out an interesting review of the effects of the merit rating rules, adopted by many states, applied to social security taxes. Walter Collins presented some figures showing that humps in employment caused by owner construction can cause a difference in taxes of 2½ per cent on the entire plant payroll over three years, a figure that may equal the entire net profit of the corporation.

Moving outside of the specialized problems of the electrical contractor, J. Norman Pierce, of Chicago, introduced a paper on the "American Way to House Americans." In this discussion of the history of national housing, Pierce asked for a complete revision of the methods of financing home construction. The cost of money, he said, is equal to the total cost of materials and far more than the cost of labor in home building today.

Rapid expansion of government has been more spectacular than the growth of any business, Col. O. R. McGuire, general council of NECA from Washington, told the delegates. Therefore, trade association representation and action in Washington is vital to protect the industry from harmful legislation, he said.

Col. McGuire reviewed the recent action of NECA officers in cooperation with other specialized contractors' representatives in opening negotiated defense contracts to electrical contractors.

## A Plea for Simplification

DR. MORTON G. LLOYD

*Chief, Safety Codes, Bureau of Standards, Washington*

**The electrical industry has made little progress in the field of simplification. Jobber's catalogues list items in tens of thousands. With the new types of wire insulation this volume of items will be considerably increased. Sixteen different methods of wiring are now recognized.**

**In each individual method of wiring, we find enormous choice of accessories and fittings. The work could be done just as well with a reduced number of models, and economy effected by discontinuing a large number of individual lines.**

**Manufacturers, distributors and consumers can cooperate with the Division of Simplified Practice in Washington in developing their program for the elimination of the excessive and needless variety of sizes and types of electrical equipment.**

**Mr. Andrae says there are now 1,500 types of outlet boxes on the market, that 80 per cent of the product of rigid conduit is the galvanized type. The City of Chicago lists 56 varieties in service switches of one manufacturer in the 60 ampere size.**

**When a thorough simplification job has been done, an item not on the simplified list may be considered "special" and the price proportioned to actual cost. There is no reason, to get it at a cost no higher than that of a stock article produced in large quantity.**

## Apprentice Training

J. W. COLLINS

*Secretary, Electrical Contractors Association, Chicago*

**Contractors select work that fits the knowledge and experience of their labor but we are paying too little attention to what kind of labor we shall have tomorrow. Soon we will find our mechanics selecting their jobs, with contractors pirating between each other for competent men.**

**In Chicago in 1930 there were 3,120 men available. Since then 295 have died, 80 were pensioned, 908 left the trade, 309 apprentices have been added. The average age of all men is 48, with 860 averaging 55 years. With an efficiency of 70 per cent.**

**The union is not doing the job nor the company school. The public trade school is our best resource but it is not practical in its training today. We need more skilled men and we've got to train them ourselves. If we don't we will be harassed by an overabundance of bootleg electricians for periodic replacements.**

**The Committee on Apprentice Training has found little or nothing being done within the trades. But NECA, in cooperation with other trades, and the Department of Labor has outlined a method of training young men for the trade.**

**We have employer-employee contract forms; a course of study and we can secure teachers and school accommodations. The Government has a trained personnel to help you set up the entire program.**

### WEDNESDAY AFTERNOON

*Bush quotes statistics*

Statistics are vital to the industry and a true picture can only be obtained from all members, A. Lincoln Bush, head of the Statistical Committee, told the delegates at the closing session. Quoting some, he showed that 3,800 contractors did an annual business of $235,600,000 at an average gross profit of 18.8 per cent and net profit of 4 per cent.

In another survey, presented to the National Defense Council, 750 contractors had a total staff of 7,344 trained men ready for action, exclusive of skilled electricians and foremen.

A new city regulation which has greatly improved wiring adequacy was described by Ellis C. Knox, chief electrical inspector of Miami. Electrical plans must be submitted to the inspection department before the building permit will be issued, he said. Architects and builders will not risk a rejection of the building permit by specifying a border line electrical job with the result that electrical contractors are being asked for help in preparing original plans and specification, he reported. The results quoted were remarkable—a 50 to 60 per cent increase in residential wiring and 200 to 300 per cent in work between $15,000 and $250,000.

At the annual banquet the next meet-

FESTIVITIES *preceding the banquet, around the table are T. H. Curry, W. L. Williams, Herbert Haile, Mr. and Mrs. C. E. Terrill, Mrs. W. L. Williams, Mrs. T. H. Curry.*

CONFERENCE *on merit clauses in social security taxes gets R. A. Goeller of New York, J. W. Collins of Chicago and W. H. Emich of Philadelphia into a huddle.*

SLIDE RULE *"wirometer" for quickly calculating wire problems was explained by H. G. Knoderer of G. E.*

LEGISLATION *affecting contractors was discussed by Col. O. R. McGuire, Washington.*

## The American Way of Housing

J. NORMAN PIERCE
*Pierce Electric Co., Chicago*

I suggest a program involving voluntary cooperation of capital, business and labor, with government financial help by:

1. Locating housing on inexpensive sites subject to rural taxes.
2. Reducing the title and foreclosure costs.
3. Reducing actual building costs through mass production.
4. Reducing the interest rate.

The concrete highway and used car make outlying farm lands available for homes.

Why can we not have titles at least approximately as simple as an automobile title that sets the holder back about fifty cents? The system of foreclosures needs to be revised and simplified, and the red tape eliminated.

I advocate 2½ per cent as a mortgage interest rate in connection with low cost home projects. We aren't talking of building a house here or there but many at one point.

Working out tax exempt government bonds issued against F. H. A. guaranteed mortgages, kept in a depository by the government for the owners of the mortgages. Private enterprise to utilize the government credit now available to housing through the F.H.A. plan.

We then could have a liquid financial medium in the form of a tax exempt government bond to finance a modern small home, with a plot of land, that could be purchased with a 10 per cent down payment and monthly payments of between $10 and $20.

## Labor Relations

E. C. CARLSON
*Carlson Electric Co., Youngstown*

The introduction of IBEW labor relations to NECA was due to need for a better national relationship between contractors and their employees. During its two years of operation the Labor Relations Committee's progress has been hindered by numerous obstacles—government regulations, investigations, profitless contracts. But, contractors are showing a determination to use good sense. This spirit coupled with cooperation and salesmanship will secure the recognition that rightfully belongs to this contracting industry of ours.

Conditions, good or bad, are a product of long standing. It is the policy of the Labor Relations Committee and IBEW to create better understanding between local joint conference committees. Lack of "better understanding" is the cause of practically all our industry discord. Most labor troubles emanate from lack of regular periodic joint conferences. The support of the majority of the 4000 IBEW employers in the U. S. and Canada as a unit would give great strength and recognition to this group.

The Labor Relations Committee has as its objectives 1. Loyal support 2. Sales promotion 3. Respect for others 4. Arbitration of labor disputes 5. Providing assistance 6. Close contact with labor officials and 7. Proper installation standards. The total of these surely spells Better Understanding.

## "And Florida Hospitality"

While business sessions were going on, wives and friends of the delegates enjoyed a splendid entertainment program arranged by the Jacksonville Chapter.

The ladies enjoyed a trip to Marineland, famous for colorful sea life and ancient St. Augustine on Monday, winding up with a bridge party in the evening. Tuesday they visited the naval air base and lunched at the Florida Yacht Club. Then to Ponte Vedra Inn for an afternoon of sports and beach parties.

On Wednesday a trip to the Oriental Gardens and Epping Forest, pause for luncheon at the Harriet Beecher Stowe Lodge in Manderin, and an early return to the Hotel in time to prepare for the annual banquet ended the program.

Many of the visitors joined a post convention tour to Havana. On Thursday morning a party of 116 left by bus for southern Florida and the 6-day tour planned by W. W. Ingalls.

## Bush Gets McGraw Award

At the annual banquet, A. Lincoln Bush of New York, Chairman of the Statistical Committee received the James H. McGraw Contractor Award for 1940 for outstanding service to the industry. L. K. Comstock of New York made the presentation for the Committee of Awards. The citation read:

"A. Lincoln Bush, president of the Belmont Electric Company, New York City, for thirty-five years has been an indefatigable worker for the advancement of the construction branch of the electrical industry. Long ago he conceived the idea that if there is any good at all in association work, it should be definitely organized into a man's regular program of activities to insure him the utmost in the satisfactions of service, the advantages of wider contact and acquaintance and the practical benefits that come of progress in his industry. He proceeded to make this a working principle and set aside a specific amount of time each week to be devoted to cooperative endeavor. Through his membership in the local, state and national organizations

ing place was announced as Houston, Texas.

The resolutions committee headed by D. B. Clayton of Atlanta, presented the following resolutions, all approved unanimously by the Convention.

1. That NECA work toward a change in compensation insurance rates to a base of man-hours instead of dollars of payroll.

2. That NECA continue to oppose efforts of government agencies to include the work of specialized contractors under the general contract.

3. That NECA urge direct contracts between specialized contractors and owners or architects to prevent the control and selection of such contractors by the general contractor.

4. That NECA express its thanks and appreciation to the Jacksonville Convention Committee and the many others who assisted in the convention program.

## Elections

Four division committeemen, whose terms expired this year were unanimously reelected for another three year term:

Division No. 1, New England—Harry A. Pierce, Pawtucket.

Division No. 4, East Central—E. C. Carlson of Youngstown, Ohio, as executive committeeman.

Division No. 7, Middle West—H. C. Evans, Kansas City.

Division No. 10, Northwest—S. A. Hepler, Seattle.

George Andrae of Milwaukee, chairman of the Code and Standards Committee, was named an executive committeeman at large, a new post created this year.

PACIFIC COAST *delegates around the table are A. L. Stone of Los Angeles, Warren Penn of Burbank, C. L. Chamblin of San Francisco and J. J. Newitt of Los Angeles.*

RECESS *gives Lincoln Bush of New York and Walter Geiss of Kansas City a chance to talk shop. Linc was the recipient of the James H. McGraw Award.*

JACKSONVILLE COMMITTEE *is introduced, standing H. A. Sonnenberg, Jr., S. C. Reddick, D. L. Carroll, H. G. Miller, W. O. Henderson and T. E. Satchwell.*

EXHIBITOR *C. W. Higbee, sales manager, Wire and Cable Division, of the United States Rubber Company, New York, snapped between sessions in the Exhibit Hall.*

of electrical contractors, this naturally led to a growing participation in association affairs, through committee assignments and election to office, until this work become not only a major interest but gradually placed upon him an accepted responsibility to assume those burdensome and unglamorous tasks which others shirked. And these activities soon began to occupy much of his days and nights.

For four years he has served as an executive committeeman of the National Electrical Contractors Association. For fourteen years he has headed the New York State association as president or chairman of the board, where he has sponsored much legislation needed for the electrical contractor, improving the relations between employers and labor and assisting with the problems of individual city groups. Mr. Bush also evolved the plan whereby the two largest contractors' associations in New York City were united and he has been the president or board chairman of this association for many years. Here recently he evolved and brought into operation a work sharing plan in which employers and labor are successfully cooperating in the electrical construction industry of New York City. For eleven years he was vice-president, for two years president and he is now chairman of the Electric and Gas Association of New York City, which with others he was instrumental in organizing as a consolidation of the New York Electrical League and the New York Electrical Board of Trade.

Together this is a record of service unique in electrical history. It stands a tribute to his continuous and unselfish devotion to his industry over this long period, to his zeal for progress, his eagerness to serve, his sincerity of purpose, his honesty, his character, and his capacity to accomplish what he undertakes. And so he has been a driving force behind practically every constructive cooperative effort by electrical men within New York State."

Mr. Bush was selected for this award by a committee of contractors appointed by the National Electrical Contractors Association, including: J. J. Bauer, New York; W. E. Frazer, Philadelphia; E. G. May, Albany, and S. J. O'Brien, New York.

## Electrical Products Show

Adjoining the meeting hall and in the entrance way 64 manufacturers displayed the wares of the industry. Conduit, wire, panelboards, switches, fuses, circuit breakers, outlet boxes, fittings, lamps, fixtures, controls and transformers were on display. A lot of interest centered around the new small diameter wires and fluorescent fixtures.

Those exhibiting were: Frank Adam Electric Co., Allen-Bradley Co., Allied Metal Stamping Co., American Coolair Corp., American Electric Switch Co., Appleton Electric Co., Anaconda Wire & Cable Co., Automatic Electric Heater Co., Benjamin Electric Mfg. Co., Bridgeport Switch Co., Bright Light Reflector Co., Bryant Electric Co., Bussman Mfg. Co., Central Conduit and Tube Co., Chase-Shawmut Co., Clayton Mark Co., Columbia Cable & Electric Co., Crescent Wire & Cable Co., Crown Stove Works, Edwards & Co., Electrical South, Essex Wire Corp., Fresh'nd Aire Co., General Electric Co., Gill Glass & Fixture Co., Grahling Bros. Co., Harvey Hubbell, Inc., Holdfast Rubber Co., Hygrade Sylvania Corp., Ideal Commutator Dresser Co., Illinois Electric Porcelain Co., Jefferson Electric Co., Killark Co., Knox Porcelain Corp., Kwikon Co., Martin Stamping & Stove Co., McGill Mfg. Co., Midwest Electric Mfg. Co., Armored Cable Section, N.E.M.A., National Electric Products Corp., National Transformer Corp., Pass & Seymour, Inc., John I. Paulding Co., Porcelain Products, Inc., Sangamo Electric Co., Shepler Mfg. Co., Silver Springs, Fla., Diorama Display, Square D Co., Steel City Electric Co., Steel Tube Division—Republic Steel Corp., Thermador Mfg. Co., Thomas & Betts Co., Triangle Conduit & Cable Co., Trumbull Electric Mfg. Co., U. S. Expansion Bolt Co., U. S. Rubber Co., Wadsworth Electric Mfg. Co., Walker Bros., Walker Electric Co., Westinghouse Electric & Mfg. Co., Wiegand, Edwin L., Wiremold Co., Wurdak Electric Mfg. Co., Youngstown Sheet & Tube Co.

1. WELCOMING SMILE *belongs to W. W. Ingalls of Miami . . .* 2. SALESMANSHIP *was ably sold by D. B. Clayton of Atlanta . . .* 3. MIDWESTERNERS *from K. C., Fred E. Geiss, A. E. Smiley, Wm. Wachter and M. A. Havenhill . . .* 4. METROPOLITANITE *Steve O'Brien from New York takes the flash over his shoulder. . . .* 5. CHICAGO SPECIAL *train provided Ed Kearns. Earl Nelson and Charlie Paulsen a cozy spot for trading yarns.*

# What Have We Got to SELL?

By
**Ray W. Ashley**

**Some pointers on what and how contractors should sell. Also a new analytical chart designed to help sell the industrial man. This was presented at the Florida convention.**

WHENEVER electrical contractors discuss selling their services, there always seems to be a lot of talk about high pressure sales methods without much thought about what they have to sell. For selling the services of the electrical contractor is more than just figuring a set of plans and signing the contract because of a low bid; it means creating a demand for their services and a willingness on the part of the owners and buyers to pay a fair price for these services rendered. And it's not an easy task.

There are three things which are necessary in selling our services as electrical contractors. First we must know what we have to sell; then we must be able to show a dollar and cents value of our product; and finally we must be able to give an understanding and convincing presentation of these figures to the prospective buyer. Knowing what to sell is less than half our task; presenting its value in understanding words is the major part.

Let's see just what we have to sell. A well organized and properly equipped contractor may list the following items:

1. An organization to handle work expeditiously.
2. A capable engineering staff familiar with the design and construction of electrical installations.
3. A well organized staff of skilled mechanics.
4. An adequate stock of tools and equipment.
5. Capable superintendents and construction foremen.
6. Sufficient men to maintain work schedules.
7. Flexibility of man power to meet fluctuating job demands.
8. Diversity of mechanics to meet various types of work in electrical construction.
9. A good reputation backed by sound financial standing.
10. Proper type and amount of insurance to protect owner against damage suits.

Just how we are to conduct our selling depends on who the prospective buyer may be. There are three main avenues open to us, namely: the architect or engineer, the general contractor and the owner. In the last ten or fifteen years the necessity of our dealing with general contractors has increased. This is opposite to what we hope for but the reasons seem evident.

There is a growing tendency on the part of the owners and architects to let all the work to one contractor. This they do to cut the expense of superintending the jobs and coordinating the various trades. This responsibility they let to the one general contractor. Knowing the weakness of sub-contractors, the general will beat their prices down to a point where he can resell the job far below the original bid and still have a good profit for himself. And so long as we are willing to throw our profits away and donate our services to the glory and profit of these general contractors, we will find them more than willing to accept our benevolence. This is not a problem for the electrical contractors alone, but for all sub-contractors, and architects as well. The architects and all pipe trades should put up a combined front to eliminate the brokerage type of general contractor.

### Working With the Architect

The architect has always been one of our best salesmen. In return we must aid him in every way possible and try to eliminate the "Jerry Cruncher" type of contractor who is always trying to resurrect profits buried in hopes of extras, especially those due to omissions or oversight. There are many ways in which the electrical contractor can aid the architect.

1. While figuring the job, the estimator can watch for and report omissions and lack of coordination in the plans.
2. The successful contractor can be on guard to iron out difficulties due to shortcomings of plans and specifications.
3. The contractor may absorb minor changes to save the architect embarrassment.
4. Other trade superintendents may be contacted before work begins to forestall difficulties.
5. Contractors should get together with architects to guarantee, in advance, completion date and price.
6. Owner should be guaranteed that each trade will be under direct supervision of a trained specialist.

Unless architects do cooperate with the various trades, many of them will eventually find themselves obscure employees of the brokerage type of general contractor.

### Selling to the Owner

Dealing directly with the owner presents the best opportunity for real selling. Dealing with an institution that has been doing its own electrical work gives us a chance to get back some of the business we have been steadily losing. Some of this loss was due to a certain apathy on the part of contractors during the heyday of new building construction when we were too busy chasing new brick piles to bother with alteration and reconstruction work. Had more of us persisted in selling high grade services to these institutions, there would have been less tendency for them to hire their own crews. But boom times, when mechanics are scarce and time is important, offer the easiest

## COMPARATIVE COSTS
### FOR ELECTRICAL INSTALLATIONS

| ITEMS OF EXPENSE | CONTRACTOR DOES WORK① REMARKS | LABOR | MATERIAL | OWNER DOES WORK REMARKS | LABOR | MATERIAL |
|---|---|---|---|---|---|---|
| MATERIAL REQUIRED FOR JOB | | | 7000.00 | BASED ON CONTRACTOR'S PR. | | 7000.00 |
| TRADE DIFFERENTIAL & QUANT. DISC② | | | | AV. 10 % LESS THAN CONTR'S. | | 700.00 |
| MAT. WASTED, SPOILED, & NOT USED | | | | 6 % OF MAT. COST (7700.00) | | 462.00 |
| TAKING OFF QUANTITIES & LISTING③ | INCL. IN GEN. OVERHEAD | | | CONST. ENGRS. TIME – 2 % OF MAT. COST (7700.00) | | 154.00 |
| ORDERING MAT. – ASSISTING PUR. AGENT | " " " " | | | CONST. ENGRS. TIME – 1 % OF MAT. COST (7700.00) | | 77.00 |
| FOLLOWING UP & COORDINATING DEL. | " " " " | | | CONST. ENGR'S. TIME – 1-1/2 % OF MAT. COST (7700.00) | | 115.50 |
| | | | | | | |
| LABOR NECESS. FOR JOB | BY AN EFFICIENT ORGANIZATION 3000 HRS. AT 1.50 (AV.) | 4500.00 | | BASED ON TIME REQ. BY CONTR. 3000 HRS. AT 1.00 (AV.) | 3000.00 | |
| LAB. LOST DUE TO FLUCT. OF JOB, UNSKILLED MECHANICS, & LACK OF ORGANIZATION④ | | | | | 1400.00 | |
| ELECT. CONST. ENGINEER⑤ | INCL. IN GEN. OH. & LAB. BURDEN | | | TIME SPENT DURING ACT. CONST'N. 12 WKS. AT 75.00 | 900.00 | |
| SHOP DRAWINGS & PLANS | LAB. – 2 WKS. AT 50.00 MAT. & BLUE PRINTING – 25.00 | 100.00 | 25.00 | LAB. – 4 WKS. AT 40.00 MAT. & BLUE PRINTING – 25.00 | 160.00 | 25.00 |
| TOOL COSTS – CONSUMED, DEPRECIATED, & TESTING EQUIPMENT⑥ | 5 % OF LAB. – VALUE OF TOOLS AVAILABLE FOR JOB – 800.00 | 225.00 | | EST. 50 % OF VALUE OF TOOLS FUR. BY CONTRACTOR | 400.00 | |
| INSURANCES⑦ | 5% OF LAB. (4500.00) | 225.00 | | 5 % LAB. (4400.00) | 220.00 | |
| | | | | | | |
| TOTALS | | 5050.00 | 7025.00 | | 6080.00 | 853.50 |
| GEN. OVERHEAD & LABOR BURDEN | 30 % ON LAB. (TEE 10 % ON MAT. – HANDELING & GUARN- | 1515.00 | 702.50 | 30 % ON LAB. 5 % ON MAT. | 1824.00 | 426.70 |
| TOTAL COSTS | | 6565.00 | 7727.50 | | 7904.00 | 8960.50 |
| PROFIT | 10 % ON LAB. & 10 % ON MAT. | 656.50 | 772.75 | | | |
| TOTAL COSTS TO OWNER | | 7221.50 | 8500.25 | | 7904.00 | 8960.50 |
| COMPLETE COST | 15721.75 | | | 16864.50 | | |

NOTES

①-CONTRACTOR GUARANTEES – WORKMANSHIP, MATERIALS, OPERATION, & COMPLETION DATE. CONTRACTOR REQUIRES SIX WEEKS TO COMPL. JOB – OWNER REQUIRES TWELVE WEEKS.

②-THIS ITEM ALSO INCLUDES LOSS DUE TO INEXPERIENCE IN THE SELECTION & PURCHASING OF ELECTRICAL MATERIALS & EQUIPMENT.

③-THIS, TO BE DONE PROPERLY, REQUIRES THE SERVICES OF A WELL TRAINED ELECTRICAL CONSTRUCTION ENGINEER.

④-CONTRACTORS EMPLOY MECHANICS WHO HAVE BEEN SELECTED AND TRAINED OVER A PERIOD OF YEARS AND WHO CAN EXECUTE WORK WITH DISPATCH.

⑤-TO GET THE PROPER INSTALLATION, IT IS IMPERATIVE THAT THE JOB BE IN CHARGE OF AN ENGINEER WHO SPECIALIZES IN ELECTRICAL CONST. WORK & IS POSTED ON PRESENT EQUIPMENT, CODE REQ., & MODERN INSTALLATION PRACTICES.

⑥-RESEARCH SHOWS THAT FOR ECONOMICAL EXPENDITURE OF LABOR, THE CONTRACTOR SHOULD HAVE APPROX. $800.00 WORTH OF TOOLS AVAILABLE FOR THE JOB. IN ADDITION TO THE TOOLS, SUPPLIED BY THE CONTR., THERE WILL BE THOSE OWNED BY THE MECHANICS. WITH TEN MEN ON THE JOB, THE COMPLETE COMPLEMENT OF TOOLS, MADE AVAILABLE BY THE CONTR'S. ORGANIZATION, WOULD REPRESENT AN INVESTMENT OF APPROX. $1800.00. MAN HOURS ARE SAVED BY SUFFICIENT AND PROPER TOOLS.

⑦-NO ALLOWANCE HAS BEEN MADE FOR THE LOSSES WHICH THE OWNER (EMPLOYING HIS OWN MEN) WILL INCUR BY UNBALANCING HIS UNEMPLOYMENT COMPENSATION RECORD. THIS WILL AFFECT THE ENTIRE PLANT PAYROLL.

ELECTRICAL CONTRACTORS' ASS'N. OF CITY OF CHICAGO 10-7-'40

entree to industrial plants and other large institutions.

Owners advance the following reasons for organizing their own electrical crews:

1. The wage difference between contractors mechanics and the less skilled plant electricians.
2. Owners can buy materials as cheaply as the contractors.
3. The presence of highly paid mechanics may cause dissatisfaction and dissension among the plant men.

It is our job to show the owner where he is wrong and where he is right. If the job is "cost plus", the owner will ask, "How much will labor cost per hour?" Many contractors make the mistake, here, of quoting a labor price including insurance, tool costs, overhead and profit. If the prevailing rate it $1.50 per hour, with the following additions; insurance 5 per cent; tools 5 per cent; overhead 30 per cent and profit 10 per cent, the contractor would quote $2.35 per hour. If the owner pays $1.00 per hour for his labor, he immediately thinks he is paying 135 per cent premium for the contractors services. The contractor should quote the $1.50 basic rate, the rest is labor burden and overhead and should be quoted as such. Research on labor burden, made by the Electrical Contractor's Assn. of Chicago, showed it not unusual for industrial plants to have a labor burden of 100 per cent or more.

Sooner or later the contractor will have to substantiate his quotation and show how the owner's $1.00 rate will cost him more in the long run than the contractor's $2.35 per hour including overhead burden. The usual way is to get the purchaser to admit certain costs, then set them up to show the results. For purposes of analysis, let's reverse the order and set up the figures first. Using the owner's $1.00 rate, with the additions noted, we would arrive at a figure something like this:

| | |
|---|---|
| Wages paid (based on time for skilled mechanics) | $1.00 |
| Additional time (due to unskilled labor) 33 per cent | .33 |
| Lost time (due to job fluctuation) 10 per cent | .10 |
| Total | $1.43 |
| Engineering and Supervision (20 per cent of $1.43) | .29 |
| Excessive tool cost (10 per cent if $1.00) | .10 |
| Insurance (5 per cent of $1.43) | .07 |
| Total | $1.89 |
| General overhead on labor burden (30 per cent) | .57 |
| Total cost to owner | $2.46 |

All of which shows the owner that he is really paying eleven cents per hour more than the contractor's price.

Let us take another example, shown in the accompanying chart, of a job requiring $7,000 worth of material and 3,000 hours of labor based on the $1.50 (average rate) per hour. For the sake of analysis we have made separate columns for labor and material. In practice some contractors prefer to list these items in one column. In the case of the chart, it is assumed that plans and specifications will be supplied.

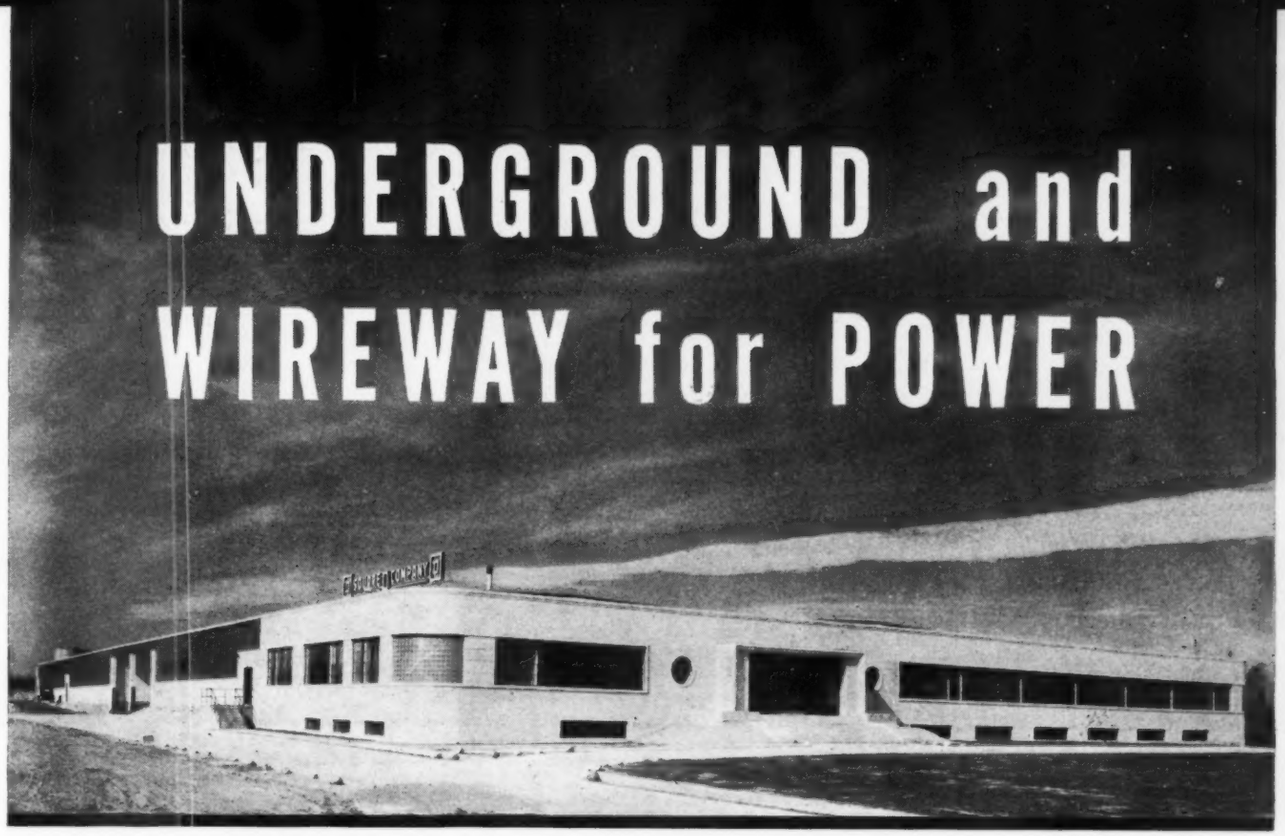
In the chart the same base price for material is used for both owner and contractor. But 10 per cent of this price is added to the owner's side because of inexperienced buying, trade differential, quantity discounts and buying in broken lots. The owner must include wasted and surplus material while the contractor can use what is left over. The owner must consider taking off material, ordering it and following up delivery, while this is in the contractor's general overhead. The owner must pay for lost labor due to poor organization, unskilled mechanics and job fluctuations. The owner must pay a construction engineer; this is in the contractor's overhead. The owner must buy many new tools; the contractor has these.

A close study of the chart will prove to the owner that it is more economical to hire a contractor to do his electrical construction work.

### Educating Prospective Customers

To expedite our selling, we must educate the public and this is a slow process. To impart knowledge to one not seeking it requires advertising. The advantages to be gained by employing a good electrical contractor must be put before the public. Contractors must make the people aware of their existence. And why not give some publicity to the apprentice training program? But the educational work cannot stop with advertising. The rest must be carried on with the opening up of the proper avenues for selling.

# UNDERGROUND and WIREWAY for POWER



**For production layout flexibility the new manufacturing plant of the Square D Company in Milwaukee employs underground feeder distribution, wireway subfeeders and unique system grounding. A. C. Electric, Inc. of Milwaukee did the job. Here's how.**

**By W. T. Stuart**

PROVIDING convenient flexibility in feeding electric power to industrial machines generally ranks as Number 1 headache in laying out new plant wiring systems. The remedy prescribed at the new Milwaukee plant of the Square D Company, which was built by the Austin Company, was wireways with unlimited accessibility to subfeeders.

But feeders from the switchboard to distribution panels had to be kept out of the way in this efficient one-story structure. Fiber conduits in a concrete envelope solved this but raised the question of system grounding. The main sprinkler header and the building frame provided the necessary continuity of ground to the underground feed distribution panels.

### Feeder System

The entire wiring installation, handled by A. C. Electric, Inc., electrical contractors of Milwaukee, begins at an outdoor sub-station at the north side of the building where the 13,200-volt, 3 phase primary is transformed to 240-volt, 3 phase power and 230-volt/115-volt lighting. The power system is 3 phase, 3 wire with one wire grounded, the lighting system is 1 phase 3 wire with grounded neutral.

The service heads consist of extensions of the main bus bar enclosure projecting through blanked out lower panes of the window behind the switchboard. Jumper cables are looped out of the bus enclosure and up to the sub-station buses, 2 sets of 750,000 cm. for lighting, 9,500,000 cm. for power.

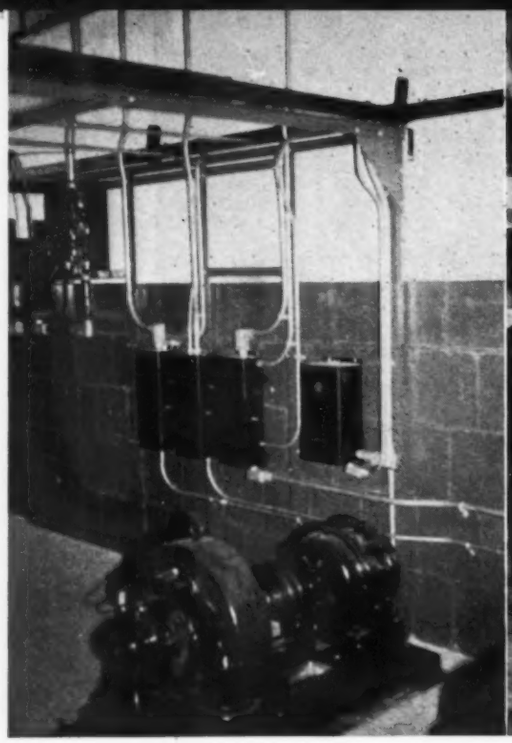
The switchboard, a totally enclosed dead front circuit breaker type, has three 2 pole main breakers, two 800 ampere capacity on the lighting service and one 1600 amp. on the power. Feeder circuit breakers control the individual feeders which drop to a trench below the switchboard and distribute underground through the plant.

### Underground Distribution

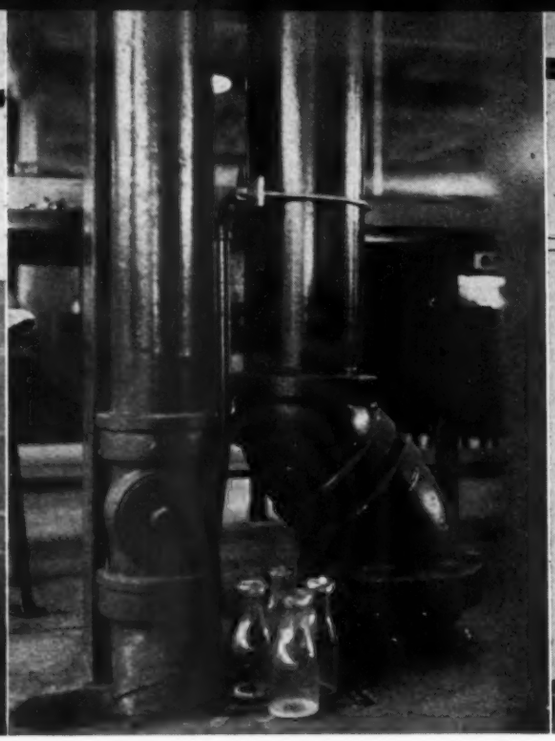
The underground feeder distribution system uses 3-in. fiber conduits in a concrete envelope under the floor of the building. Fifteen conduits extend south from the switchboard to four manholes which line up with the building columns. The underground conduits extend from the manholes to the panelboard locations terminating in a coupling and a rigid steel conduit extension where the feeder rises above the floor line.

Feeders were designed to limit wire size to 500,000 cm. This practice, widely advocated by contractors interested in wiring standardization, materially reduces the problem of reactance drop on industrial feeder circuits. The conductors have type RW water resistant insulation.

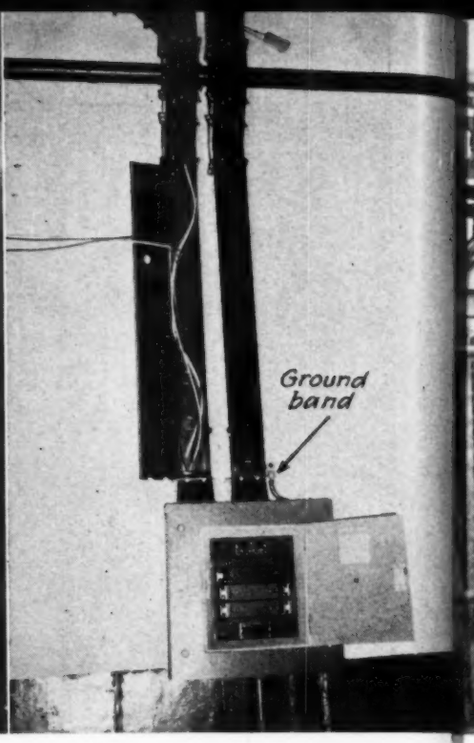
With a few exceptions each panel-



MOTOR CIRCUITS *are tapped into square duct enclosed sub-feeder, drop to motor disconnect. A 2½ inch duct carries grouped control wires to central control panel.*



M'IN GRO 'ND *terminal connected to an 8 inch sprinkler riser. A 3/0 conductor in 1 inch conduit extends to the switchboard. Sprinkler system is bonded to building.*




PANELBOARD GROUND *is a short bare copper wire with solderless lugs bolted to building column and panelboard. Columns are bonded to the sprinkler system at the risers.*

board has a separate feeder to the main switchboard. It is designed for under 1.5-volts loss in the circuit.

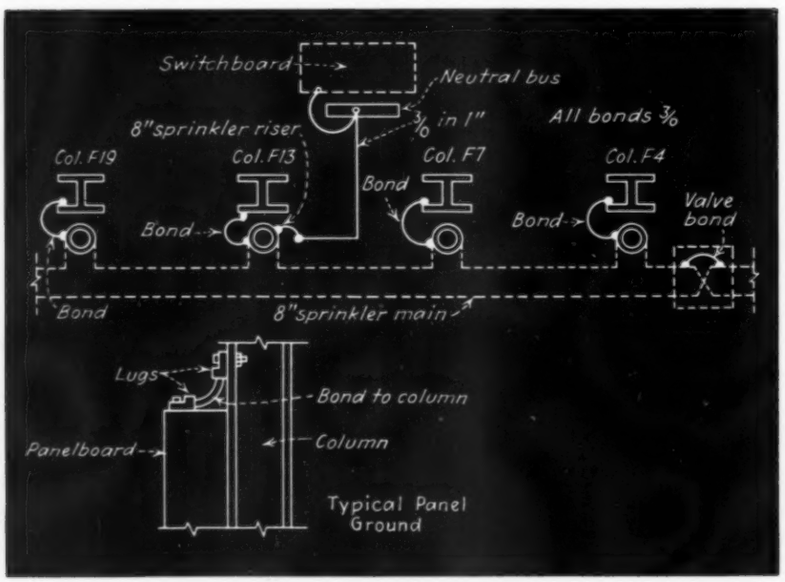
### Power Sub-Feeders

Most of the power driven machinery and equipment in the plant is provided with individual motor drives employing fractional horsepower and integral horsepower motors up to five horsepower. This load is fed through a system of 4-in. "Square-ducts" extending from the panelboard and suspended overhead above the machinery served.

Panelboard circuit breakers control No. 2 sub-feeders extending through the wireway system. Above each machine a No. 8 circuit tap is made with solderless connectors and dropped in rigid conduit to a disconnect switch. From the disconnect, the circuit is extended to the motor and motor control equipment with wire sizes appropriate for the size of the motor. Circuits for large motors or heavier loads are carried through the same wireways.

All of the Square-Duct carrying power circuits is of uniform height from the floor so that when a machine is moved from one location to another the conduit leading to the machine can be readily connected at another point. As there are runs of Square-Duct both lengthwise and across the factory, it is easy to relocate machinery at small expense.

Similar wireway systems in both the 4-in. and 2½-in. dimension are employed for other systems in the building. In the basement under the general offices wireways are used to distribute telephone circuits with short stubs up to floor stands under the desk. In the test department the wireways enclose the many small conductors that are used for distributing the test circuits. In the heating plant the elaborate control circuits and motor feeds are carried in a wireway divided into two parts by a continuous barrier.

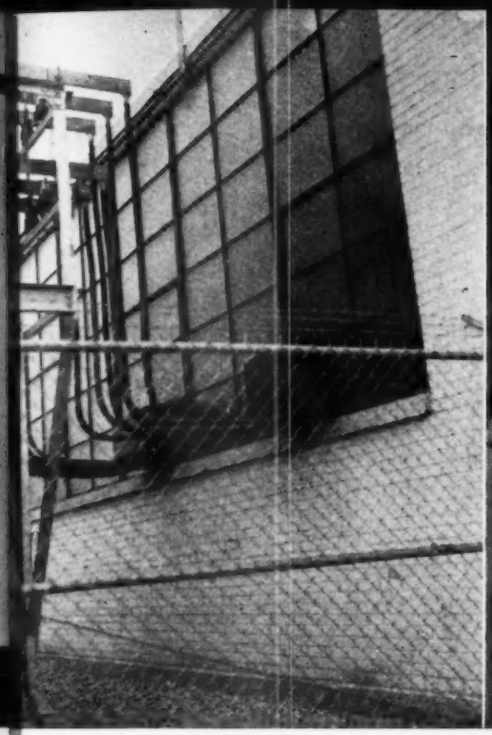



SPECIAL GROUNDING *system, shown in the diagram, was necessary because of nonmetallic underground conduits.*

### Lighting System

The installation includes a high intensity incandescent lighting system capable of providing adequate and comfortable illumination independent of daylight. The lighting equipment in the plant consists of disconnecting type RLM hoods on 13 by 12-foot centers, suspended 12-ft. above the floor. The units provide from 25 to 35 foot-candles on the working plane at bench level with 500-watt white bowl incandescent lamps. The fixtures are wired three to a circuit with No. 12 wire between the outlets and No. 10 three wire home-runs to the circuit breaker lighting panels.

In the office space 500 watt indirect fixtures on 10-foot centers provide up-



SERVICE ENTRANCE *jumpers connect substation secondary bus to buses in steel enclosure projecting through window opening. Power conductors are multiple 500,000 cm.*

FLOOR HANDHOLES *are divided into two compartments, lighting left, power right. Feeders are laced together and identified with stamped metal tags.*

FIBER CONDUIT *ends at a coupling under the floor, rigid steel conduit elbow and stub extend up to the power cabinet. Sub feeders are distributed through square duct.*

wards of 35 foot-candles. Skylights above the office are equipped with 500-watt glass steel diffusers on 10-foot centers above the skylight panels. The skylight units are controlled by a photocell device which automatically turns them on when the light outdoors drops below a predetermined intensity. The lighting system is wired in electrical metallic tubing.

Because of the break in the continuity of the conduit grounding system in the underground feeders, a special grounding plan was developed. It was worked out with the cooperation of the Wisconsin Industrial Commission. The main system ground, 3/0 in one-inch conduit, was extended from the switchboard and neutral bus to an 8-in. central sprinkler riser. The main valve at the incoming line was bonded with a 3/0 jumper. The four sprinkler risers were bonded to the adjoining building columns. Each panelboard is bonded to the column upon which it is mounted by a heavy copper jumper with solderless lugs securely bolted in place.

The continuity of the neutral conductor on the lighting system is unbroken. Therefore, the neutral is grounded at only one point, the main ground lug on the neutral bus at the switchboard.

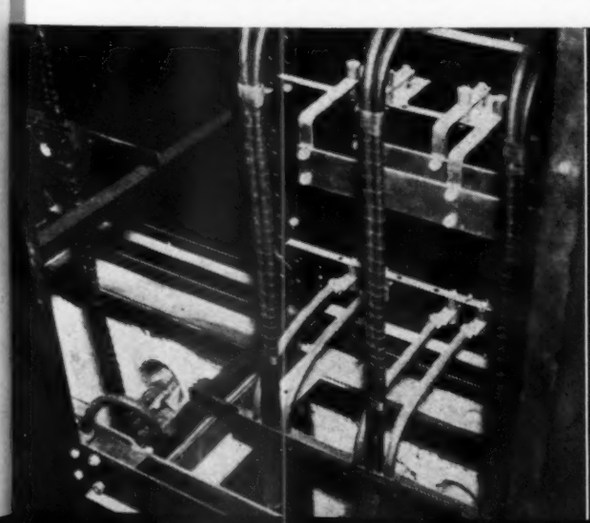
The extent of the work can be visualized from the following physical data. The plant is a single story monitor type building with brick walls, steel frame and plank on timber roof, 450- by 240-feet. In the width are five spans 40-60-40-60-40 feet, the wider spans are 18-ft. 2½-in. from the floor to the bottom chord of the monitor trusses. The lower spans are 13-ft. Columns are on 40-ft. centers lengthwise of the building.

In the electrical installation there is over 4000 feet of square duct, 4230 feet of underground fiberduct, 15,000 feet of 3/0, 4/0 and 500,000 cm. R. W. wire in the underground system, 53,000 feet of No. 12 and No. 10 code branch circuit wire.

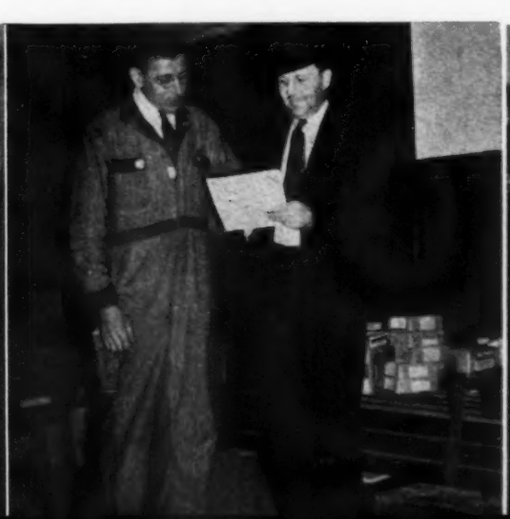
The resulting wiring system has a number of advantages for this kind of industrial load. The main feeders are out of the way and occupy no valuable ceiling space. Spare conduits permit considerable extension of the system capacity for future loads.

The wireway system provides overhead sub-feeders to the groups of machines. Altering machinery layout requires only changing the conduit run up to the wireway. Ample wireway capacity provides adequately for future sub-feeders under the code limit of 20 per cent fill.

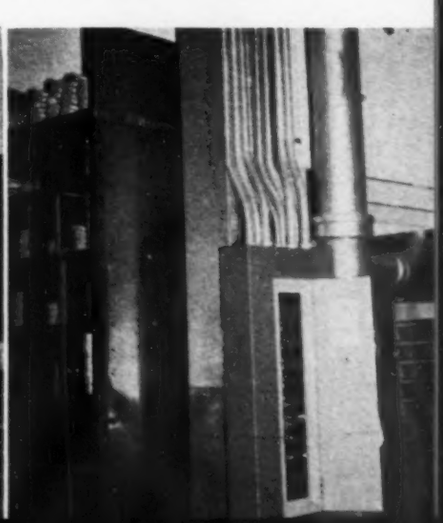
FEEDER CIRCUITS *at switchboard are laced together and drop into underground conduit system terminating in trench below.*



ELECTRICAL CONTRACTOR *Orville R. Nichols, president of A. C. Electric, Inc. checks over job with foreman, Fred Thiele.*



LIGHTING PANEL *circuits protected by branch circuit breakers feed to first outlet with No. 10 between outlet with No. 12 in E.M.T.*



# FLUORESCENT

**Seventh in a series of practical articles on fluorescent lighting. In an Aurora factory office, the Micheals Electric Company installed fluorescent "troffers" on close centers to get 50 to 85 foot candles of general lighting.**

THE successful use of coffers as a source of general lighting in low ceiling, air-conditioned offices with incandescent lamps has been followed, logically, by fluorescent installations based upon a similar method. The inherent light distribution characteristics of fluorescent lamps, however, are best adaptable to long narrow coffers or troughs. The result is the fluorescent "troffer," a deep reflector designed for flush mounting in a suspended ceiling.

A notable example of fluorescent troffer lighting was installed in the new office quarters at the All-Steel-Equip Company plant in Aurora, Ill. by Micheals Electric Company of Auora. The windowless, air-conditioned offices are located on the second floor of a new brick building, styled in modern lines with stainless steel trim. Areas of glass block on one side permits some daylight to enter, not enough, however, to be used as a source of illumination.

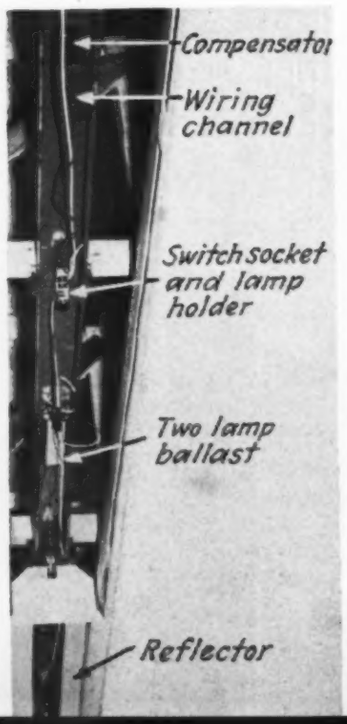
The suspended sound absorbing ceiling has a four foot access space above for the air conditioning ducts, sprinkler pipes and lighting system.

The office floor, 156-ft. from east to west and 100-ft. wide, is divided into an open office area, 59-ft. wide and 156-ft. long flanked north and south by department offices, private offices, file rooms and washrooms. The engineering department occupies one end of the open office area.

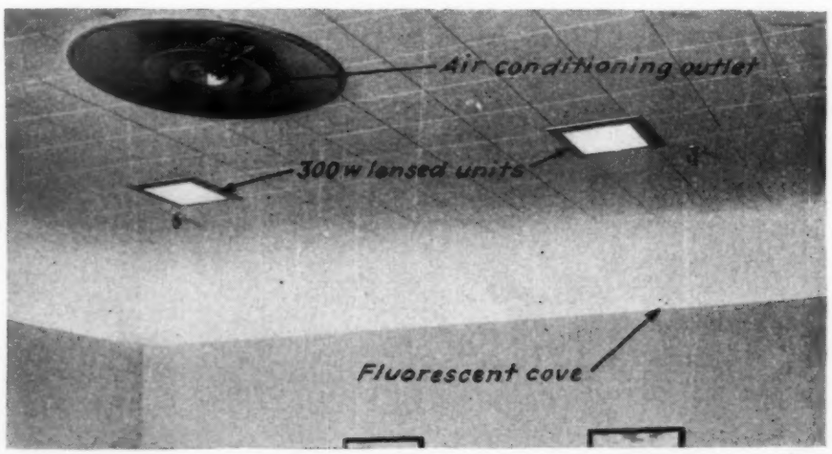
In the general office space, fluorescent troffers on 6-ft. 6-in. centers run the full width of the area. The troffers are assembled in 4-ft. sections, each equipped with a single 40 watt lamp. The wiring channel, rigidly mounted above the ceiling opening, supports the lamps and reflectors independently. Thus, the entire assembly is accessible from below for maintenance.

High power factor, two lamp ballasts and starting compensators are installed in the wiring channel above alternate sections. The circuits enter at either end, are switched at the panel board, and each controls two rows of units to approximately the center of the room.

The engineering department has similar lighting treatment but the troffers are closer together, on five foot centers. Control and circuit arrangement are the same as for the general office area. In the private offices and stenographic department and business machines department, similar layouts are employed;




WIRING CHANNEL encloses ballasts and wiring, supports reflectors and is mounted on 2 by 4's every four feet.




COMBINATION LIGHTING *in executive office uses four 300 watt incandescent flush units and a continuous fluorescent cove.*

# TROFFERS

the required lighting level established by appropriate spacing and the number of lamps in each troffer.

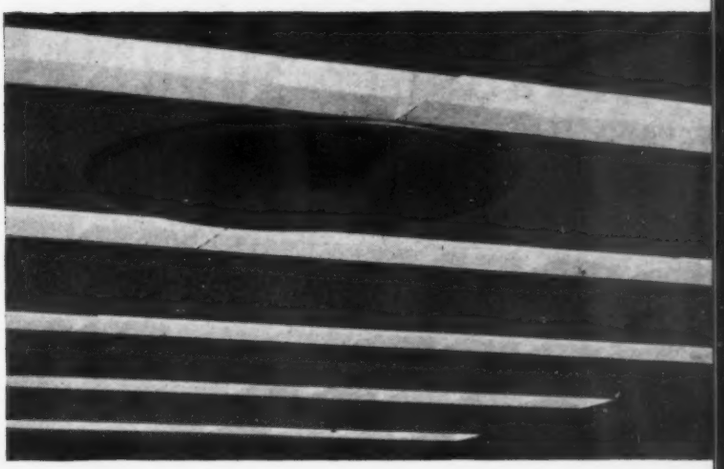
A department office, 20- by 19-feet, has four troffers on five foot centers, each consisting of four double lamp four foot sections or a total of 1280 watts of fluorescent lamps. The resulting illumination level is approximately 85 foot-candles. The same arrangement and spacing, double lamp sections on five foot centers, are used in all of the private offices. In the business machine department, single lamp sections are installed on four foot centers.

In the president's office, a combination of incandescent and fluorescent lighting are attractively blended. Fluorescent lamps are concealed in a continuous cove around four sides of the 18- by 20-foot office. Four 300-watt flush

| Room | Dimensions | Troffer Sections | Spacing |
|---|---|---|---|
| 200 | 16 x 20 | 6-80W | 9′ |
| 201 | 8 x 10 | 4-80W | 4′ |
| 202 | 8 x 9 | 2-80W | 4′ |
| 204 | 18 x 20 | 4-300W lensed 16 lamps in cove | .. |
| 206 | 19 x 20 | 16-80W | 5′ |
| 207 | 12 x 10 | 4-80W | 5′ |
| 208 | 12 x 10 | 4-80W | 5′ |
| 209 | 14 x 20 | 12-80W | 5′ |
| 210 | 12 x 10 | 4-80W | 5′ |
| 211 | 12 x 10 | 4-80W | 5′ |
| 212 | 11 x 20 | 8-80W | 5′ |
| 213 | 20 x 29 | 28-40W | 4′ |
| 214 | 59 x 156 | 364-40W | 6′6″ and 5′ |
| 216 | 14 x 20 | 12-80W | 5′ |
| 217 | 20 x 32 | 32-40W | 4′ |
| 222 | 14 x 20 | 12-80W | 5′ |
| 223 | 20 x 33 | 32-40W | 4′ |

lensed incandescent units direct light down from the ceiling. The depth of the troffer reflectors, mounted flush in the 12-foot ceiling, cuts off direct view of the lamp at normal angles, from the side, and louvers every 12-inches block direct view endwise. The "dark ceiling" effect between troffers is offset by light colors in the ceiling and wall finish.

The wiring system uses conventional code wire in conduit. A bank of three 25 kva. transformers reduces incoming 440-volt 3-phase delta to 208/120-volt 3-phase four wire. Two No. 4 and two

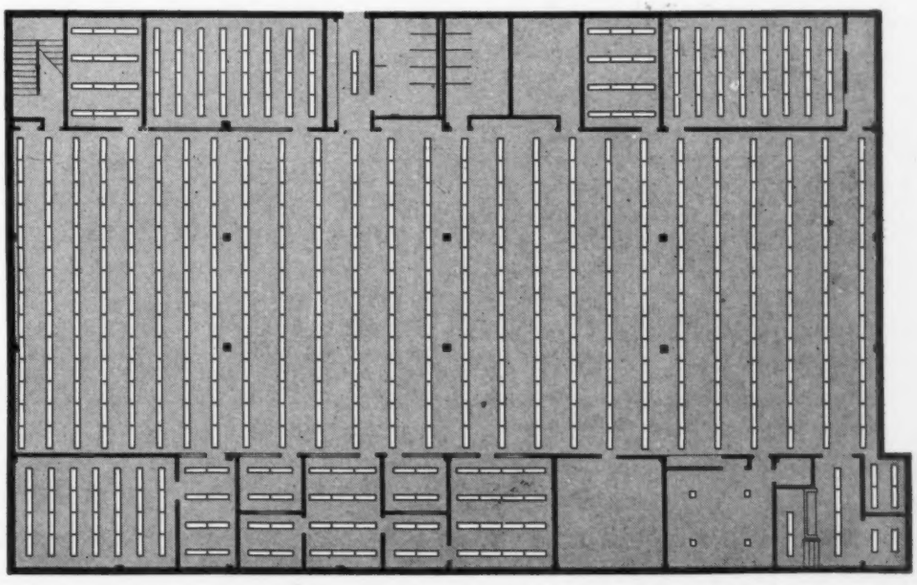


FLUSH MOUNTED, *deep reflectors open at the bottom, direct light downward. Direct view of the lamps at normal angles is blocked by louvers on 12 inch centers.*

"TROFFERS" MATCH *pattern of sound absorbing ceiling. Electrician working on 6 ft. scaffold, uses padded 2 by 4 T to hold four foot section in place for fastening to wiring channel.*

No. 6 four wire circuits feed the four office circuit breaker panel boards. Branch circuits are wired with No. 12 and No. 10 conductors with a maximum of 16 lamps to each circuit. The general lighting system in the unpartitioned open office space is controlled from the panelboards; private offices, department offices and washrooms from local switches. Eight flush night lights are installed about the general office and controlled from a panel on the lower floor. Telephone and plug receptacle outlets are installed in floor boxes.

The total power load for the office lighting installation is approximately 32 kilowatts, including 3,400 watts of incandescent lamps, 646 fluorescent lamps, plus an allowance for ballast losses. This is an overall average load of two watts per sq. ft., varying from 1.6 watts per sq. ft. in the general office space to 3.7 watts per sq. ft. in the private offices for fluorescent lighting.



PARALLEL ROWS *of fluorescent lamps in recessed reflector provides high level glare-free illumination.*

# TROUBLE SHOOTING on V-BELTS

**Seven good rules to follow in applying and maintaining V-belt drives.**

**By L. L. Smith**

*Texrope Division, Allis-Chalmers Mfg. Co.*

CONTINUOUS OPERATION. *This 125-h.p. V-belt drive operates a beating machine 24 hours a day in this paper plant.*

V-BELT drives are essentially trouble free, even under long and severe service. But, improper installation, care or maintenance can cause trouble that results in slowed up production, service calls for the contractor or motor shop, or hurry calls for the maintenance man.

A few simple rules in the installation and maintenance of v-belts will give the customer the full advantage of the sturdy engineering built into these drives—

**1.** *Use the belt designed for the conditions.* Standard v-belts are recommended for use where surrounding temperatures do not exceed 130 deg. F. Special belts of heat resisting material are available for temperatures as high as 180 deg. Where oil, dilute solutions of acids or other foreign agents may come in contact with the belt there are special oil resisting belts available. Although standard belts can be used in any such application, their normal life may be materially shortened.

**2.** *Always check for proper alignment.* The driver and driven shaft should be exactly parallel and the v-belt should be at right angles to the shaft. Any appreciable misalignment may cause unnecessary wear. The use of a straight edge will help in obtaining the proper alignment.

**3.** *Adjust for correct tension.* Every v-belt drive should include some form of movement to permit maintaining the proper tension on the v-belt. This may be slide rails on the motor, an adjustable motor base, or an idler arrangement. After the drive is lined up and installed, enough tension should be placed on it to make the v-belt tight. The tight side of the drive should preferably be on the top, however, it is not absolutely necessary. V-belts may stretch approximately 4 per cent of their original pitch length during their life. Enough movement should be allowed to permit this amount of take-up so that the proper tension can be maintained at all times. All v-belt drives should be inspected periodically to be sure the proper tension is being maintained.

**4.** *Match sets of belts on each drive.* Correct matching permits each respective belt to carry its proportionate share of the load. This matching should be in accordance with the allowable tolerances for the various size belts. For texrope belts this varies from a 0 tolerance on the 55-in. pitch length belt to a .6 tolerance on a 660-in. pitch length belt.

**5.** *Replace belts in full sets.* In removing the belts the tension should be removed from the drive and as much slack as possible obtained on the v-belt. The belt then can be easily removed and a new set of belts placed on the drive. The alignment should again be checked and proper tension applied. V-belts should never be pried on the sheave. A bar, piece of pipe, or any object that might be used for this purpose may rupture the cord construction of the belt causing it to break. Replacement should be made with a complete new set of v-belts, because it is very difficult to match two or three new belts with several old belts that have been in use and have stretched an unknown amount. The old belts taken from the drive which are still good may be used for replacement purposes in case of accident or breakage.

**6.** *Store belts in a cool, dry place.* If spare sets of v-belts are carried, they should be stored in a cool, dry place protected from light. Heat and light will cause the rubber to deteriorate and shorten the life of the belt.

**7.** *Use no belt dressing.* No belt dressing should ever be used on any v-belt drive. The principle of the v-belt drive is the frictional contact made between the v-shaped side of the belt and the v-shaped groove in the machine. Belt dressing may cause this contact to become slippery and may also cause deterioration of the belt.

# 15 Million Salesmen

## Are they working for you this year?

**Cutler-Hammer advertising . . . . for the popular and fast selling Cutler-Hammer Multi-Breaker . . . . appears this year in 9 nationally known, nationally distributed magazines . . . . Saturday Evening Post . . . . Life . . . . Collier's . . . . Time . . . . American Home . . . . Better Homes & Gardens . . . . House Beautiful . . . . House & Garden and Sunset.**

**15 million salesmen! 15 million messages telling the great home market the comfort, convunience and advantages of the Cutler-Hammer Multi-Breaker. Will those 15 million salesmen work for you this year . . . . push inquiries your way, build business for you? Let them do so . . . . push the line that pushes you . . . . the Cutler-Hammer Multi-Breaker Line. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers*, 1306 Saint Paul Avenue, Milwaukee, Wisconsin.**

CUTLER-HAMMER
MULTI-BREAKER
C-H

*Push the line that pushes you!*

Earl Whitehorne, Editor

## Selling Stands Top In Urgency

President McChesney made two important statements in his opening address, reiewing the year's work of NECA—

> "The electrical contractor is today, more than ever before, confronted with the necessity of selling his service. Yet there is a vast market for electrical construction and which is practically untouched and available now if we will but develop it."—And again later,—"The successful electrical contractor of the future will be the one who is constantly studying the needs of his selected customers, and has developed his organization in the science of selling."

This obvious truth has been ignored too long. NECA now launches a Sales Manual. This gesture of purpose is encouraging because it gives emphasis to the subject, among the diverting appeals of other affairs. Mr. McChesney now enters on his second year with a variety of crystalized objectives, that should show interesting development before another convention rolls around. None is more important than the stimulation of better selling.

## Simplification Next?

George Andrae's report on Codes and Standards again laid before the industry the interesting and important recommendations he made last year. He proposes to eliminate excess and duplicating varieties of electrical wiring materials and fittings—notably black conduit and boxes and unneeded wire sizes—and to secure the abandonment of "needless wiring methods."

The fact that these purposes apparently have not been advanced visably during the past year, and are still only in the program stage is disappointing. But meanwhile this committee has done a good job on Code revision. Perhaps the coming year can see an accomplishment in simplification. It is much needed and George Andrae is a good man to get it done.

## Sales Manual Must Be Sold

Don Clayton of Birmingham deserves a lot of appreciation in the industry. He has undertaken the development of a NECA Sales Manual for electrical contractors. He knows we are not sales minded men, and that it will be hard to make contractors read it and use it. But he has tackled the job.

The present section is the hardest part to interest people in for it is a simple primer on how-to-sell. Here men are apt to sniff and quit, saying, "Hell, I know all that!" It is the hardest part for Don to justify and promote, yet it should come first. Then will come market analysis and equipment and customer class studies—where and what and whom to sell—which will have more practical value and stronger appeal.

All this was explained in the report. But we hope the committee realizes that it is bound to encounter great discouragement with such a project, and that long, persistent selling by the committee itself will be needed to get the manual into use.

## Apprentice Training—A Suggestion

Walter Collins continues to urge upon the industry the need for apprentice training. But nothing is done. Individual contractors can not undertake the task. Local groups refuse to face it.

He now suggests that the NECA Industrial Relations Section undertake this job. They have members—They have money—They have a definite unity of purpose. And surely the providing of apprentices is a matter that concerns both contractor and labor, which is the field of their activity. It will add a constructive progressive feature to their program now principally concerned with the prevention of labor troubles.

The pinch for apprentices is coming before long. No more time should be lost. E. C. Carlson can render a great service to the industry, if he will work on this.

## Buy Unwired Fixtures

Most fluorescent lighting manufacturers regularly list their equipment for sale wired or unwired. Yet, a great many electrical contractors order wired fixtures. Why this should be so no one seems to know.

Obviously, the cost of wiring a fixture at the factory must carry overhead and profit mark-up for the manufacturer and the distributor. And savings on quantity production are not enough to offset this added cost. Also, as one manufacturer puts it,—"We would rather sell our equipment unwired. We are not in the wiring business. But when electrical contractors order wired fixtures, we must be set up to furnish them, at the lowest price we can."

Wiring fixtures doesn't sound like much. But in a year, over the whole country, the volume actually runs into millions of dollars. This is business that the electrical contractor can have for the asking.

## Profit on "Defense Work"

What may an electrical contractor earn now on a job done for a "defense contractor" on a cantonment or other government building? Well, he will get the wiring sub-contract on the same competitive basis as any other work.

The general contractor's price is

limited by his contract. He has to sublet so that he will come out on the total price for the job. His only chance is to buy as cheaply as he can, within the specifications. The electrical contractor's only chance is to see that the specifications are clear and right and to then figure a proper, safe margin of profit.

## How The Specialist Was Saved

Col. McGuire, general counsel of NECA, in his story of the sub-contractor on Government work made a strong case for the trade association. The Navy and Army were setting up a cost-plus-a-fixed-fee basis for all the building construction. But they could not pay a fee to the general contractor on a fee paid by him to a sub-contractor.

So general contractors were organizing at the expense of the United States to set up their own electrical departments and to do their own plumbing, heating, piping, air conditioning and mason work. They began to hire key men away from sub-contractors at fancy prices, and figure high costs on this work, in which they were not expert.

McGuire, President McChesney and L. W. Davis went to work on it, called in the other trade associations affected. The Army soon saw the light and set up a basis for sub-contracting to specialists. The Navy also has adjusted its attitude. The situation was saved by united action.

## War Building Now Everywhere

A lot of people thought, when Congress voted billions for defense, that guns and tanks would soon start rolling off the assembly lines. A lot of electrical contractors thought that the construction of new factory buildings would immediately begin.

But four months were lost while the government bickered over its amortization policy. Orders are now out, however, and contracts are signed for a wide diversity of products. And it is developing that industry is planning an enormous building program which has barely started.

In a word, plant capacity now in use for regular production is not being diverted to government work. Present customers must still be served. So additional buildings are being planned and constructed to an unexpected degree.

This means an enormous volume of industrial electrical work now starting and to come. It is coming almost everywhere. The simple reason is that munitions plants buy materials and parts from everybody and the business is scattered all over the country almost immediately a war order is placed.

## Radio Antennas Again

Big news in radio today is frequency modulation. After January first, when commercial broadcasting uses the new high frequency channels, sales of "FM" receivers will boom and what will this mean to the electrical contractor?

Highly sensitive receivers, in recent years, have practically eliminated the radio antenna. Electrical contractors never think of them today and few radio shops are equipped now for this installation. But for good reception, FM sets require a highly specialized type of aerial receptor, very carefully installed.

This new demand can be turned into a large volume of profitable wiring business, by a little advance sales work with your local radio dealers and department stores. There is no reason why they should set up antenna installation crews again. Here is waiting profit—if we want it.

## Back Talk

### Estimating Data

*There is a strange tradition among electrical contractors that cost expense should be kept secret. Therefore, it is extremely difficult to obtain estimating data on actual jobs for publication. Believing that it would be valuable to our readers we introduced an Estimating Data Department in the paper about two years ago.*

*All of this data has been laboriously dug out of the files of contractors about the country by our editors in the field. It has been such a chore that recently we wrote to a list of readers selected at random from across the country asking them if they found this man hour data valuable and wanted it continued. Here are some of the typical replies—*

**1. To the Editor**—Your man hour figures are valuable and they are of interest. However, we do not use them for other than a check on our own figures for the reason that although you try to allow for all of the variables, we do not think that it can be close enough. Every job has its own set of variables and we think that they must be valued in preparing all estimates.

**L. F. Spang**
**Reading, Pa.**

**2. To the Editor**—I think this is a real service and hope you will continue it.

**John C. Morris**
**Jersey City, N. J.**

**3. To the Editor**—I read parts of it concerning my type of work only. I think it is useful, and should be continued.

**Stanley Lechowicz**
**New Britain, Conn.**

**4. To the Editor**—I consider your Estimate Department very good. Keep it. Your publication is good in all departments, but let's have more information about the big jobs that are going on, pictures and information about them.

**George A. Bishop, Jr.**
**Fall River, Mass.**

**5. To the Editor**—Yes, please keep it up.

**Henry Munch**
**Omaha, Nebraska**

**6. To the Editor**—That estimating data is interesting and should be valuable for comparison with figures of our own when we find jobs which are sufficiently alike to make comparison possible. I hope you will continue the department.

**Marcus T. Lines**
**New York City**

**7. To the Editor**—Yes keep it up. An important item. It is the first department I turn to.

**H. G. Sand**
**Brookings, S. D.**

**8. To the Editor**—To me your data on estimating has been one of the most valuable collections of information. I use it and hope you keep up the good work.

**R. T. McMillan**
**Williamson, W. Va.**

**9. To the Editor**—I read each article that you publish on Estimating with interest. It is a service that we hope you can continue. No one estimator can possibly know it all and therefore a file of experiences of several will prove priceless.

**W. R. Ackor**
**Alexandria, Va.**

**10. To the Editor**—The estimating data you have published is very good and from our own experience we know it is correct but I question its use by the contractor who needs it most and will not use it, i.e. the cut throat competitor. The contractor who is intelligent enough to use this information is also intelligent enough to obtain it on his own volition. The contractor who needs it will not use it.

I have found from past experience in association work with contractors that it is almost hopeless to educate about two-thirds of the contractors in a community; the other third being smart enough to realize that they have to know their costs in order to show a profit.

For the above reasons I feel that you are spending money uselessly in compiling and printing this information for after all, the contractor who needs it probably would not even spend the amount of money for a subscription to your magazine to obtain it. Please pardon my bluntness but I am basing my conclusions on my experience with that class of contractor.

**William C. Schlosser**
**Madison, Wisc.**

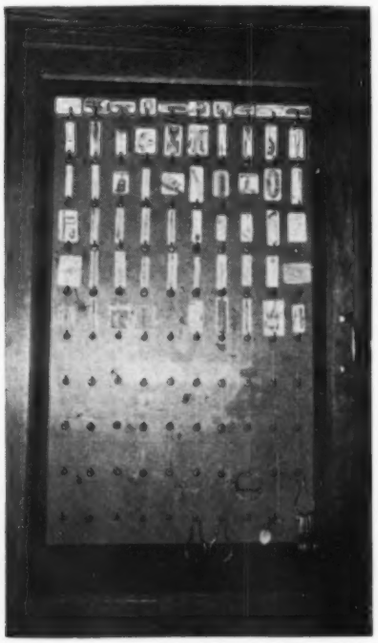
*On this almost unanimous endorsement we will continue the department. But we would welcome comments from other readers. We realize that many careless contractors who habitually guess their price will not file and refer to this data but others will use it. And the best defense against unintelligent competition is to make more and more cost experience available. Man hour data will be welcomed and paid for and we need this cooperation to make this department of more scope and value.*

# WIRING Methods

## TOOL CHECK SYSTEM

J. J. Reddington, Boston electrical contractor and motor shop man has devised a tool check system which tells him at a glance who has what tool.

This is how it functions. Each man is issued a total of 12 round brass checks, similar to hat checks. One side of each check bears a specific number,



***TOOL CHECK RACK** helps keep this contractor's tool stock and requisition records in order. A glance at the rack tells him the whole story.*

which is listed with the employee's name in the record. The other side of the checks bear numbers from one to twelve. So if a man loses his eighth check he is given another with his own number and the number eight on it.

When an employee wants a tool he goes to the stock room and asks for it, giving his check as a requisition. The clerk gives him the tool and hangs the check on a hook in a special cabinet. The cabinet contains a number of hooks with a picture of a tool pasted above each hook. A check on the hook under the picture of a 2-in. stock and die indicates that man No. 8 (or whatever number it may be) has this tool. So, at a glance, the stock room clerk can tell how many tools of each kind are on the job and who has each one. All this eliminates thumbing through notes or pads to see who has the equipment or going to the bin to count the number of tools still there. It is just one more phase of good housekeeping.

## ACCESSIBLE GROUND RODS

The maintenance of good grounding systems is important for the safe operation of electrical equipment in hazardous locations. So, in a recent oil plant installation in New Jersey, the M. W. Kellogg Co. of New York, oil refinery contractors and engineers, placed an accessible enclosure around all the ground rods of the underground bonding network.

The enclosure consisted of a 24-inch length of standard soil pipe, about eight or ten inches in diameter. The pipe was sunk into the ground with the end bell flush with the finished grade. The rod was driven in the center of the enclosure and the bare copper conductor brought up and connected by a solderless clamp to the top of the rod. A flush type cast metal cover with a lifting ring fits in the end bell and keeps the area around the rod always accessible.

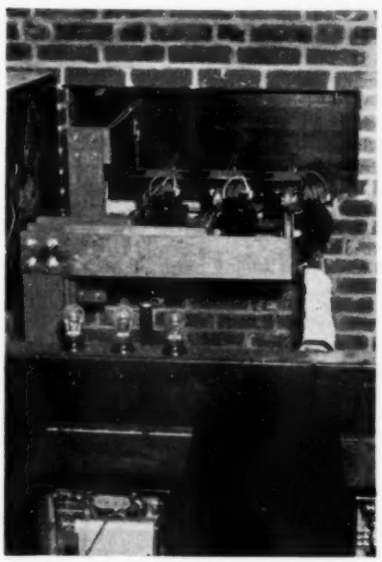
***ACCESSIBLE ENCLOSURES** for ground rods permit frequent inspections and tests of the grounding system.*

This type of "ground rod pot" makes it easy to conduct frequent ground system inspections and tests. If the earth around the rod is too dry, the area can be treated by placing the proper material in the "pot" surrounding the rod.

## OVERHEAD METERING TRANSFORMERS

To save space and at the same time keep the metering transformers out of the way, yet accessible, the Garden Electric Co., Inc., of Elizabeth, N. J. mounts them overhead on the incoming buses.

For this particular installation in a New Jersey manufacturing plant, the



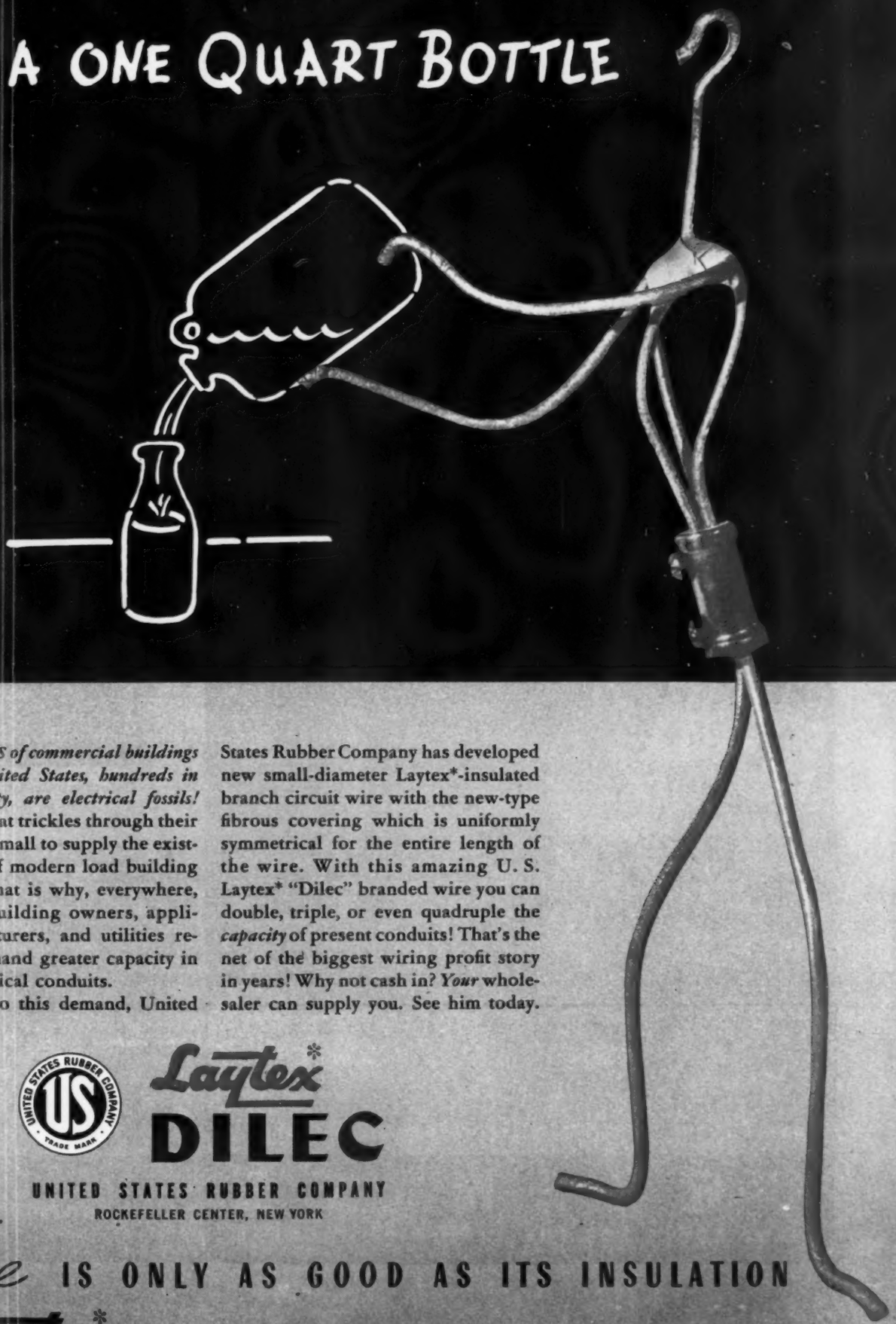
***METERING TRANSFORMERS** are mounted overhead on the incoming buses to permit close grouping of buses at switchboard and keep back of meter panels free for meter wiring only. Note ground detector lamps on top of panel.*

current transformers were mounted directly inside the building wall on the secondary incoming buses consisting of two ¼- by 4-inch copper buses per phase. The wires from the transformers to the meters on the board are grouped together and fastened to the angle iron switchboard support by protective layers of linen tape.

This method permits closer grouping of the phase buses at the switchboard and keeps the back of the meter panels available for meter wiring only.

The three lamps mounted on the top of the meter panel are neon ground detector lamps to warn the plant electrician when a ground develops.

# HOW TO PUT A GALLON OF "JUICE" INTO A ONE QUART BOTTLE



*THOUSANDS of commercial buildings in the United States, hundreds in your community, are electrical fossils!* The current that trickles through their wiring is too small to supply the existing demand of modern load building appliances. That is why, everywhere, consumers, building owners, appliance manufacturers, and utilities require and demand greater capacity in existing electrical conduits.

In answer to this demand, United States Rubber Company has developed new small-diameter Laytex*-insulated branch circuit wire with the new-type fibrous covering which is uniformly symmetrical for the entire length of the wire. With this amazing U. S. Laytex* "Dilec" branded wire you can double, triple, or even quadruple the *capacity* of present conduits! That's the net of the biggest wiring profit story in years! Why not cash in? *Your* wholesaler can supply you. See him today.

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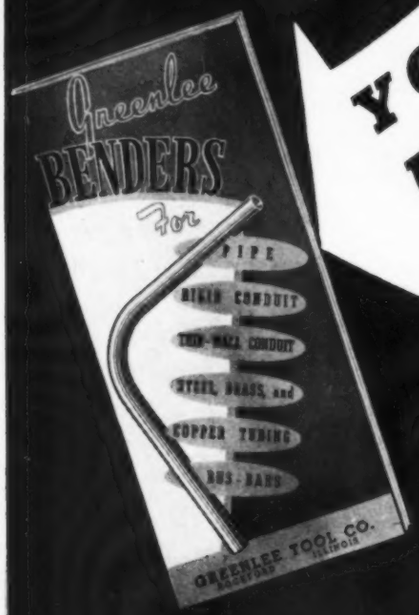


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GREENLEE
HAND TOOLS FOR THE ELECTRICAL WORKER

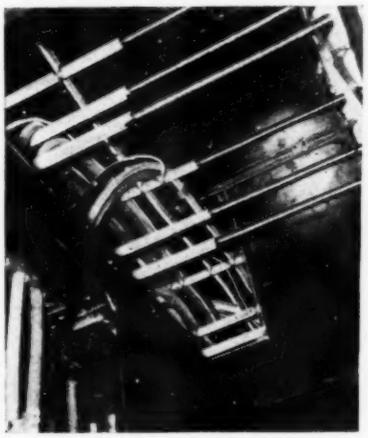
WIRING Methods

[FROM PAGE 28]

## PULL BOX CABLE RACKS

The main switchboard in the new building of Tiffany & Co., New York, supports a huge heavy gauge steel pull box. The enclosure is 18-feet long, the length of the board, and is approximately 30-inches high and 60-inches deep. Branch circuit feeders from 30 light and power distribution panels throughout the building terminate in this box and fan out to their respective circuit breakers on the board.

To support this mass of conductors, Lord Electric Co., New York, the electrical contractors on the job, designed a series of cable racks which would support the cables and at the same time give adequate sweep to the conductors extending down to the switchboard bus bars. These racks are constructed of



*INSULATED CONDUIT is used for cable racks in the large pull box above the main switchboard in this building.*

five-foot lengths of 1-inch conduit insulated with a fibre tube which slides over the conduit. In some cases the diameter varies depending upon length of rack, number and weight of cables supported. Each rack slides through holes drilled in supporting flat iron brackets mounted on the back and front of the pull box. These brackets extend inward from the walls of the box a few inches to give a rigid support. The racks are mounted in vertical tiers and spaced horizontally to give adequate support to the cables and ample room for bending to make the connections.

The conductors are grouped according to circuits, wrapped at various points with a strong twine and tied to the racks. Access to the pull box is provided by a removable panel at the front of the board and a removable bottom at the rear of the switchboard.

# New LEVITON 260 LINE OF TYPE C TOGGLE SWITCHES

Here is a new series of switches that can be loaded up to full capacity with ample safety—a durable, high speed, knife action type of mechanism designed for long life under all conditions. Large head 8-32 binding screws for easy wiring, and a sturdy strap, permanently fastened to the housing without screws, makes this switch trouble-free from loosening in service.

Use this new T-Rated line for your heavy Type C lamp loads.

★ *Note the raised toggle pad which assures quick wall plate alignment and keeps the toggle free from binding against the wall plate. This pad also protects the switch against dust and improves the appearance.*

Cat. No. 260—Single Pole—Rated 10A, 125 V.T.
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For residential, industrial use, or wherever wiring devices are needed the KWIKCHANGE line fits the job. Each combination can be easily assembled, in any desired scheme—and there are hundreds of combinations to suit all requirements and conditions. Bring your wiring job up to date with KWIKCHANGE.

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# Motor Shops

## SHOP INCINERATOR

During the recent expansion of his motor repair shop, Edward Kotz, proprietor of the Electrical Motor Repair Co., Trenton, N. J., built a shop incinerator in one corner of the stripping room.

It is constructed of cement block and is lined with fire brick, making a total wall thickness of 13-inches. It measures six feet square on the outside, is 6-ft. 1-in. high, has a cement floor and a

***BRICK INCINERATOR** in this shop burns insulation from coils to be stripped while getting rid of shop refuse. Scrap copper thus treated brings higher prices.*

4-in. reenforced concrete roof slab. The brick chimney has a 24-inch flue, extends 12-feet above the top of the fire box and provides enough natural draft to keep the fire going and draw off all the resultant smoke and gases.

The large steel door in the front is 4-ft. 2-in. high and 3-ft. 2-in. wide. It is constructed of ¼-inch steel plate and hangs by two hinges from a 3-in. by 3-in. angle iron frame. Five 1-inch holes drilled 9-inches from the bottom of the door together with a 2¼-in. by 6¼-in. rectangular opening cut 3½-in. from the bottom maintain the natural draft.

This newest piece of equipment in the Kotz shop serves a three-fold purpose. It is used to burn up all the scrap wood, cartons and other material that accumulates in a repair shop. At the same time motors that are to be stripped are placed in the fire to burn the insulation off the coils. To accomplish this, the proper degree of draft was experimentally determined to keep the fire burning slowly to prevent overheating and warping of the slot laminations. Finally, this incinerator is used to burn the insulation off all the scrap copper wire that accumulates, thus commanding a better price in the scrap copper market. Since this organization is also in the contracting business, a substantial quantity of odds and ends of large copper wire comes back to the shop to make this operation profitable. So this one simple piece of equipment helps prepare motors for stripping, helps prepare scrap copper wire for the market and helps keep the motor shop clean.

## MOTOR BASE RACK

The L & P Electric Co., of Brooklyn, N. Y., believes in good housekeeping for its motor accessory stock as well as for its motor shop. One section of the second floor of the building is devoted to motor base and rail stock. Hundreds of motor bases of various sizes are stored here on a rack designed expressly for that purpose.

The rack is constructed of angle iron and built up in tiers. It tapers inward from the floor to the top row so that no base extends beyond the rack frame-

***MOTOR BASE FILE** is what this rack really is. Bases are tagged and stored in the rack like letters in a pigeon hole. It saves both time and energy.*

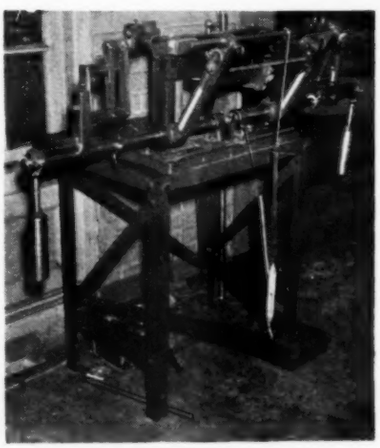
work. Thus accidents caused by protruding bases are eliminated. Conduit "pins" are supported by the two horizontal angles. Two J hooks with large eyes slide over these pins and the motor bases are hung on these hooks. When removing a base the first hook is unfastened, the base pulled out and the second hook disengaged.

All large and heavy bases are suspended from the first tier, the medium sized ones from the middle tier and the smaller ones from the top row. Single motor rails are stacked on the floor and on top of the rack. This arrangement eliminates lifting and juggling the heavier equipment.

All bases are tagged to facilitate locating the proper base for a specific motor. It all adds up to a simple systematic method of storing spare motor bases—easy to get at and to get out.

## COIL SPREADER

A coil spreader designed and built in the motor repair shop of Electrical Engineering and Service, Inc., Westfield, Mass., has the unique feature of putting a kick-up or arch in the coil ends so they nest closely against each other when placed in the stator. Each coil arch has a definite radius so the coils



***ARCHED COILS** are formed by special knuckle arms on this machine. Unique stop bar gives accurate coil size.*

in a completely wound stator give a uniform effect and form a perfect circle.

The coil arch is produced by the use of special knuckle arms on the coil spreader. Each arm has a jaw which clamps in the nose of the coil and is counter weighted to keep it in a vertical position. The knuckle mechanism rotates freely on its axis so the jaws can travel in the desired coil arch. When the coil is spread, the entire knuckle attachment slides horizontally to a stop collar, then the jaws rise vertically to a predetermined position to give the

# HAZARDEX

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ELECTRIC RANGE POWER CIRCUITS
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✓ **PROPER LIGHT CONTROL**—that's what you're buying—not just a fixture. Be sure the reflector puts the light *where* you want it—uses the lamp's full efficiency, without waste of light.

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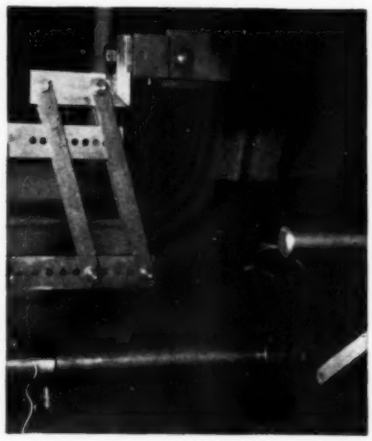
## Motor Shops

[FROM PAGE 32]

correct arch. Sufficient play in the knuckle arm is afforded by the use of hardened steel collars over the bolts. When the bolts are made up tight there is about 1/64-inch clearance.

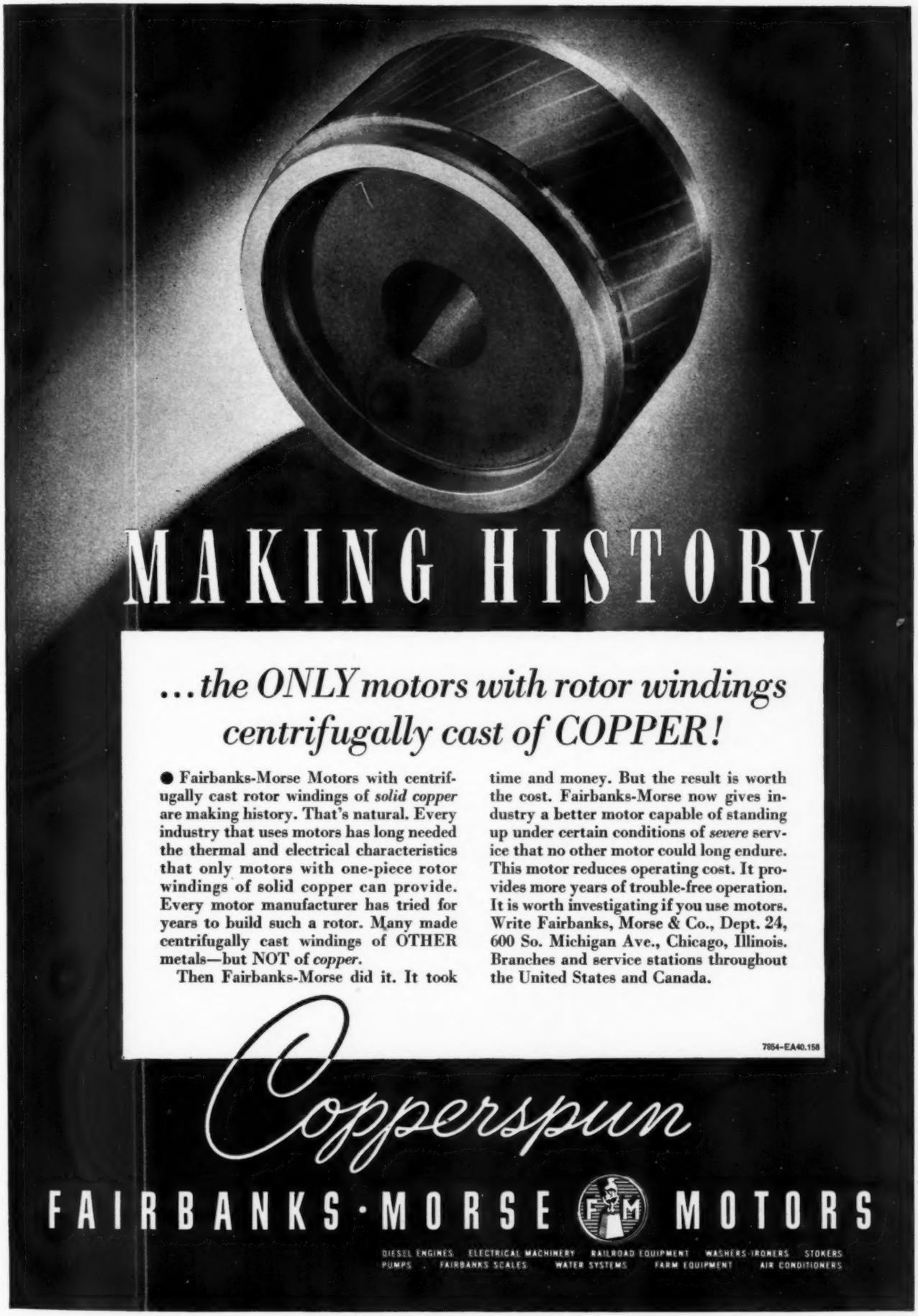
Another unique feature of this machine is the stop bar, which is a threaded bar with an adjustable head that rests in a V shaped seat mounted to the stationary support of the coil grip. A locknut holds the head in place and permits close adjustment. The front



*CLOSE UP of one of the knuckle arms showing the jaw that clamps the coil nose and rises vertically to produce the coil arch.*

of the bar is mounted on a heavy cross bar near the coil slots on the front lever mechanism of the spreader. Since the stop and adjustment are near the coil itself, greater accuracy in coil size is possible. In some cases where the stop is down near the base of the lever arms, a difference of a small fraction of an inch, possibly due to wear, makes a much greater difference in the coil size.

*BREAKDOWN TESTS are being made with a high potential transformer on a sample coil for two huge 230 h.p. synchronous motor stators in the shop of the L & P Electric Co., Brooklyn, N. Y. These motors, formerly operating at 440 volts are being rewound for 4156 volt service. Each stator, approximately seven feet in diameter, requires 330 pounds of copper for its 165 coils.*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...the ONLY motors with rotor windings centrifugally cast of COPPER!
● Fairbanks-Morse Motors with centrifugally cast rotor windings of *solid copper* are making history. That's natural. Every industry that uses motors has long needed the thermal and electrical characteristics that only motors with one-piece rotor windings of solid copper can provide. Every motor manufacturer has tried for years to build such a rotor. Many made centrifugally cast windings of OTHER metals—but NOT of *copper*.
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# Better Lighting

*SOFT SHADOWLESS illumination of 50 foot-candle intensity is provided by 300-watt silvered bowl lamps in coffered ceiling units.*

## DIRECT CURRENT OPERATION

While fluorescent mazda lamps are designed for a.c. operation, they may be used on d.c. circuits if the specially designed d.c. auxiliary and approved series resistance of the correct value are employed. Direct-current operation usually results in decreased over-all efficiency of light production, useful lamp life, lumen maintenance and starting reliability. Present tests indicate that only 18- and 24-inch lamps should be used on direct current. Present glow-switch starters are not recommended for d.c. operation. On the other hand, color quality and total light output of lamps compare favorably with a.c. operation and the stroboscopic effect is eliminated. The different resistance values and d.c. losses using GE auxiliary 58G562 are given below for 110- and 120-volt circuits. This auxiliary is of the built-in thermal switch type with an over-all size of $1\frac{7}{16}$ by $1\frac{3}{4}$ by $7\frac{7}{16}$ inches.

| Lamp | D-C Lamp Current, Amps. | External Resistor Required, Ohms* | | D-C Loss per Lamp Auxiliary + Resistor, Watts | |
|---|---|---|---|---|---|
| | | 110 V. | 120 V. | 110 V. | 120V. |
| 18-inch T-8 | .30 | 165 | 198 | 18 | 21 |
| 24-inch T-12 | .31 | 112 | 144 | 14 | 17 |

*Based on 32 ohms internal resistance of 58G562. Care must be taken to use resistors which will handle the lamp current without exceeding the auxiliary temperature.

## ANGLE REFLECTORS

Units of this type can be used to supplement the general overhead lighting and to build up the lighting on vertical surfaces. They may also be used to light individual machines, auto wash racks, and other operations that demand special distribution or direction of light. Special care is necessary in locating and shielding them to avoid their becoming glare sources to workers who face toward the units.

For fairly uniform lighting laterally

along a vertical surface, the spacing between units should not exceed one and one-half times their distance out from the lighted surface.

## COFFER LIGHTING

The Sales Accounting office of the Carboloy Company, Detroit, Michigan, incorporates a coffer ceiling. Each coffer, which is made of a special plaster, incorporates a 300-watt silvered bowl lamp. The lamps are spaced 8 feet apart and mounted 9 feet 9 inches from the floor. The 50 footcandles provided is of the same high quality as would be obtained from indirect lighting.

The difference between a coffer and ordinary indirect lighting, as regards softness of shadows and reflected glare, isn't very great. The two principal advantages of coffers from the illumination standpoint are (1) the brightness area of the ceiling is concealed from the ordinary field of view; this results in a degree of eye comfort or "optical coolness" which becomes increasingly important at high illumination levels, and (2) the coffer is inherently more efficient.

*GLARE-FREE BOWLING—A battery of 15 Westinghouse floodlights provide eye-comfort lighting for ten alleys in the Zenith Bowling Alleys, Springfield, Ohio. The units are equipped with 200-watt lamps and are arranged in groups of three for each pair of alleys, and mounted 12 ft. above the foul line. Two units in each group have diffusing reflectors. There is no specular reflection from the highly glossy surface of the alleys. Glare is eliminated and perfect visibility is claimed to prevail for bowlers.*

# Ready AFTER DECEMBER 18th

## Two RLM 60" Mazda FLUORESCENT Twin-Lamp LIGHTING UNITS

*Showing how the use of apertures in RLM 60" Fluorescent Diffuser Unit provides ceiling illumination that is uniform and free from shadows and bright striations.*

● These latest RLM approved Fluorescent Units for the new 100-watt Type F Mazda Lamps when installed at the conventional ten foot spacing and mounting heights provide the higher levels of illumination demanded by present day industrial requirements. Moreover, adequate levels of lighting are now attainable in locations requiring higher mounting and wider spacing. Essential features of these two new units are: Shielding angle of 14 degrees; Porcelain Enamel reflecting surface for diffusion and durability with reflection factor of 79%; light output efficiency of 75%; in addition, the apertures of the diffuser unit direct 2% of the light into the upper zone; corrected for power factor and flicker with ballast equipment approved by E.T.L. and Underwriters' Laboratories.

Insist on RLM Labeled 60" Fluorescent Units. This RLM Label is your assurance of their compliance with rigid specifications and periodic inspections... has nation-wide recognition as a warranty of uniformity and quality. Only units bearing this label are RLM approved.

*The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers*

**RLM STANDARDS INSTITUTE**
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225 N. MICHIGAN AVE. SUITE 615 • CHICAGO, ILL.

THE CERTIFICATE OF RLM UNIFORM QUALITY

RUBBER COVERED POWER CABLES • BUILDING WIRE

CRESCENT IMPERVEX

MOISTURE RESISTANT RUBBER INSULATED BUILDING WIRE

It is made especially for use in damp locations in place of lead encased cable and is approved by Nat'l Elec. Code and Und. Lab. for such use.

Due to its smaller overall diameter and easier working characteristics, more wires of the same size or the same number of wires of larger capacity may be used in new wiring or rewiring existing conduits.

For more than seven years, IMPERVEX underground cables have been giving completely trouble-free service wherever installed, including the principal utility systems.

**Send for Bulletin on CRESCENT IMPERVEX**

CRESCENT INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

CRESCENT ENDURITE SUPER - AGING INSULATION

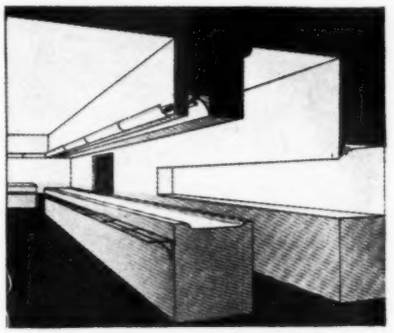
Better Lighting

[FROM PAGE 36]

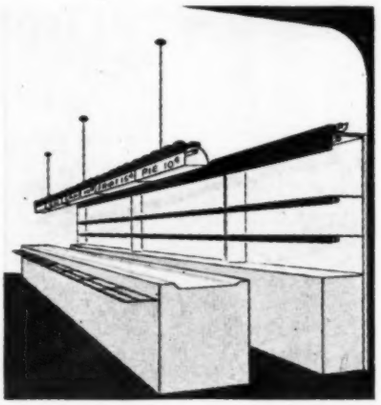
## LIGHTING RESTAURANT SERVING AREAS

Special lighting is required for the service areas such as found in cafeterias and many business man's lunch rooms. Not only should these areas have a brightness attraction of their own, but they should also make food displays as appealing as possible.

Being a linear source, the fluorescent lamp is well adapted for this service. The two schemes sketched have been



*COVES AND TROUGHS hide the fluorescent lamps from the customer's view and permit eye appealing displays.*



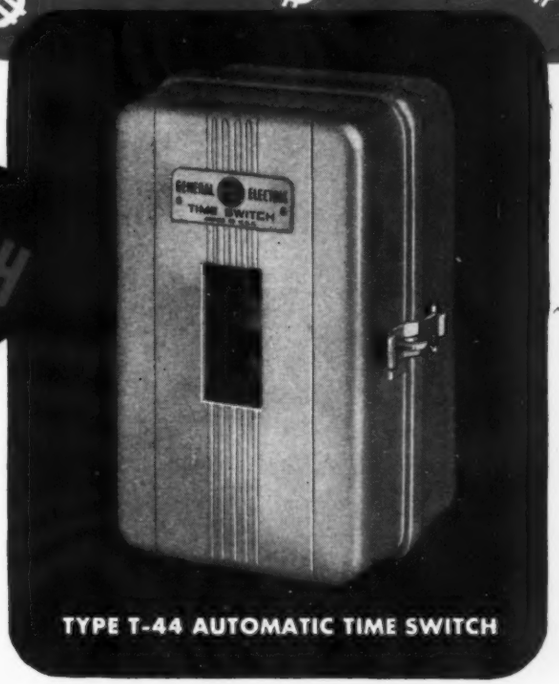
*SUSPENDED TROUGH with luminous sign front and direct fluorescent units behind valances illuminate counter and shelf food displays.*

planned for maximum in eye appeal.

Recent observations were conducted in a restaurant to obtain opinions on appearance of food and complexions with various colors and combinations of fluorescent lamps. Practically all comments were those of men. Although there was the usual divergence of opinion, they favored the white lamps. The effect was judged principally at lunch time. Shielded lamps were preferred as compared with exposed lamps, even in the case of the 1½-inch diameter lower brightness lamp.

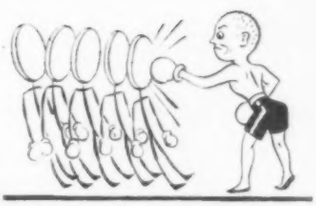
# WANT TO ADD EASY PROFIT TO YOUR WIRING JOBS?

## USE THIS G-E TIME SWITCH




TYPE T-44 AUTOMATIC TIME SWITCH

## It's Easy to Install
## Easy to Wire and
## Saves Call-backs



**It's easy to install** because two mounting holes and a hanger lug give full provision for mounting. Five standard knockouts in the back, bottom, and sides make it easy to attach leads from any direction. And you don't need to remove the switch mechanism from the box to mount it.

**It's easy to wire** because the connections are clearly marked and there's plenty of wiring room below the terminals. Side hinges keep the cover out of the way and leave both hands free for fast work.

**It saves call-backs** because it's timed and powered by the well-known Telechron motor, and this assures long, accurate service without attention. Also, its silver contacts are conservatively rated at 35 amperes—they'll hold up easily under MAZDA, inductive, or resistance loads.

### AND THIS TIME SWITCH WILL HELP YOU SELL YOUR WIRING JOBS

The G-E monogram on thousands of products is a symbol of reliability to users of electric equipment. They like its promise of service. Your reputation plus the G-E monogram on the time switch will help assure ready acceptance of your wiring bid.

Write today for a copy of our bulletin, GEA-1427, describing this time switch in detail. You can obtain a copy from the nearest G-E Office, or from General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

NIX ON THAT
ELECTRICAL
BUYERS REFERENCE

# BOOK, MAUD!

## *A moving book gathers no dust . . .*

● No sir! No dust gathers on Electrical Buyers Reference. It's the *busy* man's book—the book that's packed full of buying information. The book that's got WHAT you want to know, WHERE you want it, and WHEN you want it . . . classified, indexed, and cross-indexed.

Electrical Buyers Reference is the electrical man's buying bible. Sections like these make specifying and buying easier, quicker:

- Manufacturers' Catalog Section
- Classified Directory of Manufacturers
- Index of Company and Trade Names
- Index of Product Classifications

*Complete* listings make obscure products easy to find. Condensed catalogs of over 300 companies (in the Manufacturers' Catalog Section), plus Classified listings of over 3,500 companies, are included—and that takes a walloping load off the catalog pile. It makes Electrical Buyers Reference your one central source of buying information.

EBR is the most valuable book in your office—and the more you use it, the more valuable it becomes.

USE it once today, and you'll use it twice tomorrow. Because EBR saves time . . . and money. Because EBR gives you the information you need, *quick as the flip of a page.*

**WATCH FOR ANNOUNCEMENT!**

The *new* Electrical Buyers Reference — 1941 edition — will soon be ready for distribution. Completely revised, with new listings, expanded manufacturers' catalog section, and bigger than ever, EBR for 1941 will be ready around the end of December. We'll be able to give you full details on this extra useful volume next month. Meantime, use your 1940 EBR to speed up buying for year-end rush jobs.

*Electrical* BUYERS REFERENCE

330 WEST 42nd STREET, NEW YORK • A UNIT OF THE McGRAW-HILL REFERENCE SERVICE

## At Tiffany's New Building

[FROM PAGE 11]

through a transformer which produces 6000 volts on the secondary. The transformers are mounted in an accessible dummy drawer in the lower part of the rear of the case.

One distinct advantage of this type of lighting is that it requires only a small reflector of about 1-inch cross section which is finished on the outer side to blend with the show case. Also, this tubing can easily be bent to conform to the contours of the case and thus produce a continuous light source around the entire display area. Because of the high voltage characteristics of this particular system, extreme care had to be exercised in the grounding and installation of the transformers and tube connections. The special approval of the city electrical department was required before it could be used.

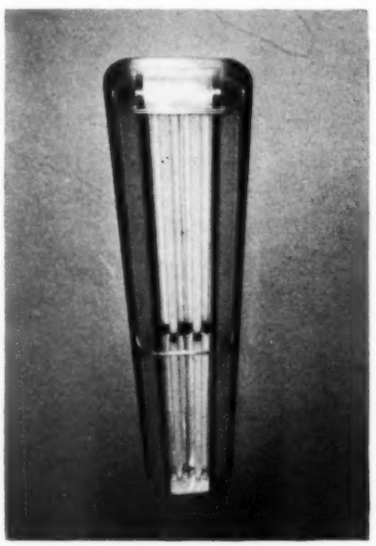
### Fluorescent Units

On the second and third floor sales areas, fluorescent lighting was used throughout both for general and show case lighting. The general lighting consists of long semi-flush fluorescent units using from eight to 16-40-watt white lamps depending on the length of the unit. Each section of the unit employs four 40-watt lamps. All lamps are covered with two round fluted ground glass panels and a flat panel of the same material in the bottom of the fixture. All auxiliaries and wiring are concealed in the wiring channel of the fixture recessed in the ceiling.

The second floor contains approximately 450 feet of this type of lighting arranged in long rows or squares or rectangles, depending on the ceiling beam structure and separate room partitions. The third floor contains approximately 450 feet of this type of general lighting. The average illumination intensity on the top of the counters is 45 foot-candles.

The wall and island show cases in these areas are also illuminated by fluorescent lamps concealed in reflectors mounted inside the upper front edge of the cases. These units use 36-inch white lamps, the number depending on the length of the case. The inside top walls and bases of the cases are lined with a black velvet material so there is no reflection of the light source for the customers to see. The lighting intensities produced by these lamps in the show cases average 40 foot-candles.

The customers' diamond offices and the powder rooms on the second floor are illuminated by decorative cove lighting employing filament tube lighting. This lighting is similar to the common "lumiline" except that the filament tubes in this case are bent to follow the line of the cove around the room. Inside white lamps are used. In addition, in the ceiling of each office, are mounted 150-watt flush incandescent in-built lens units with prismatic reflectors and adjustable sockets for varying the beam angle. So there will be soft lighting for the customer's comfort and the direct down lighting, when necessary, for the close inspection of the merchandise to be sold.



SEMI-FLUSH, *two section fluorescent unit, typical of those installed in the sales areas. Glass panels on bottom of this unit are removed to show the lamps.*

For general office illumination, luminous bowl indirect incandescent units are used. In the private offices are metal bowl indirect and semi-indirect fixtures employing a number of 75-watt inside frosted lamps in mirrored glass prismatic reflectors mounted in the indirect bowl. They face the ceiling at various angles to give uniform high intensity illumination.

A dual underfloor duct system is used in the general office area for low tension telephone, low tension wiring and lighting and receptacle circuits. A bell and buzzer call signal system is installed between floors and departments with an eight drop annunciator located in the timekeeper's office.

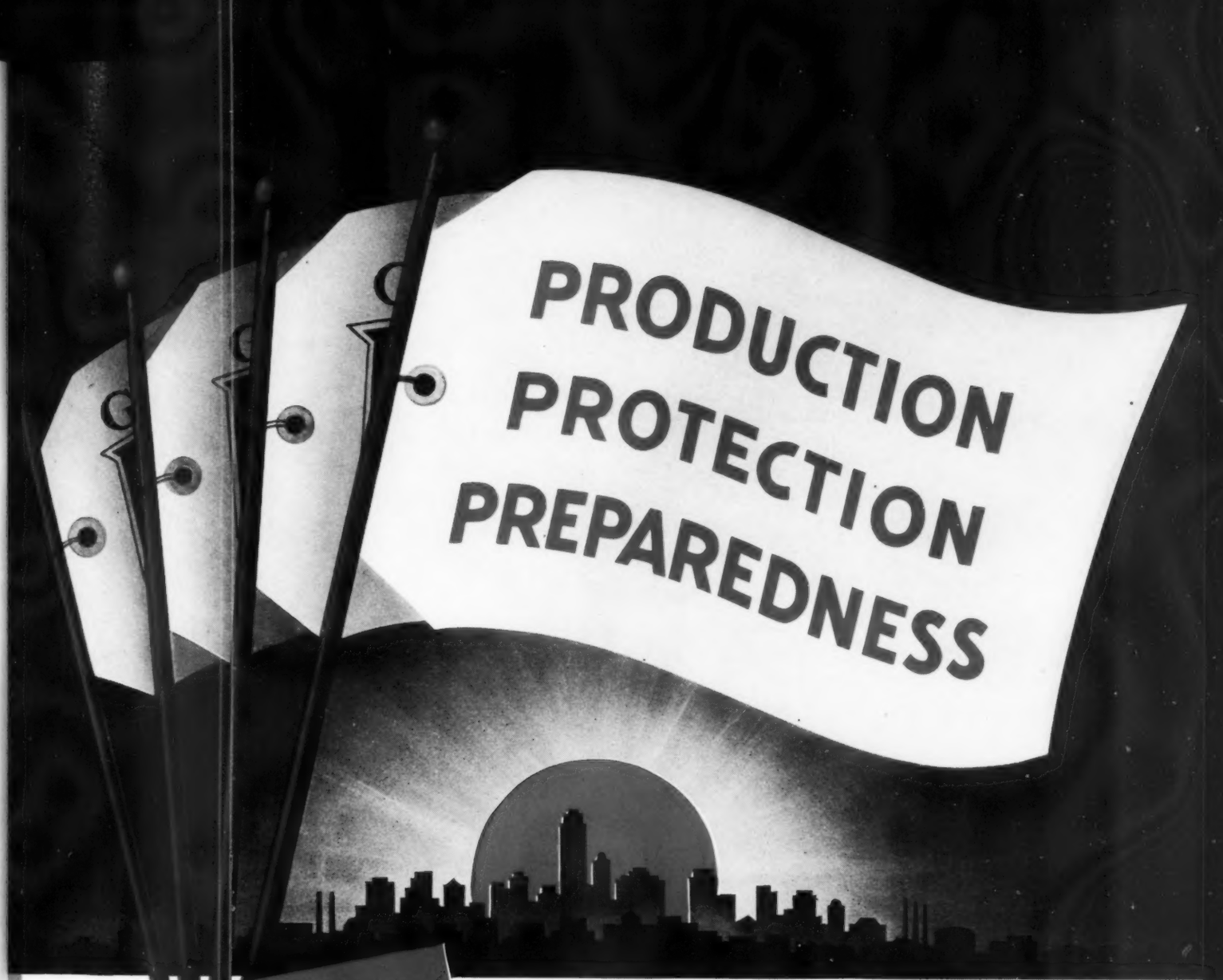
In the work shop and stock room areas, glassteel diffusing units are mounted. Individual work benches have small fluorescent bracket lamps employing two 9-inch tubes, for close work and a receptacle for any portable tools which may be required. The shop area on the seventh floor is equipped with a 60 ampere, 120-volt, single phase, two pole Feedrail system complete with 51 trolleys. Fluorescent lighting is used over inspection tables in these areas.

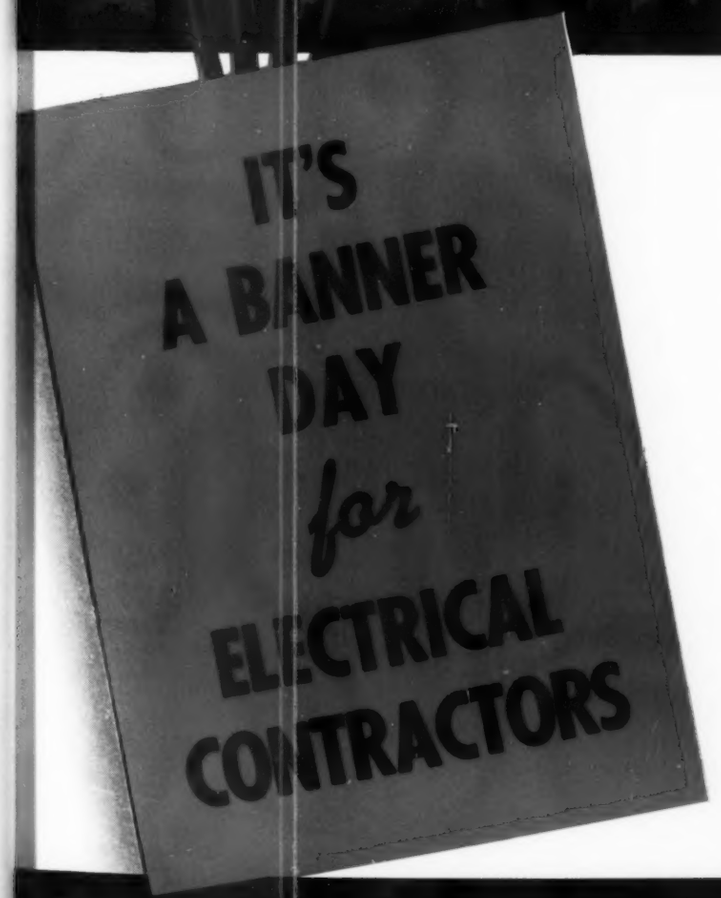
### Close Cooperation

Close cooperation between the owners, architects, engineers and contractors permitted the establishment of a special laboratory and testing room in the old building where extensive experimentation and tests were made to develop the power and lighting system that was finally installed. Here the various electrical problems were studied for adequacy, operating efficiency, maintenance and adaptability to the structural and architectural design of the building. Fixture manufacturers were called upon to exert their ingenuity and skill in producing units that would conform to the engineers requirements. And the contractor had to utilize his skill in installing the system so as to remain within the appropriate limits afforded by the structural design of the building.

What does an installation of this type signify? It is a highly specialized job from the standpoint of lighting design. But, it is an outstanding example of what can be accomplished by the combination and blending of different lighting systems to produce results demanded by specific application problems. It indicates the growing tendency of merchandising organizations to place a high value on the importance of light upon the display and sale of their goods. It highlights the tendency to discard the practice of using one type of lighting throughout an entire building, regardless of the variety of occupational functions in the organization. It illustrates the modern trend to place increased importance upon proper and careful engineering as an integral part of a good electrical system. And it shows the rapid progress being made in the science of lighting and its growing responsibility in business.

These are developments which no contractor can ignore. For in these times, when business is called on to increase production, individual seeing tasks and convenient, efficient use of electricity are assuming an important role. Problems like these will be coming up every day. The contractor must be prepared to help solve them.



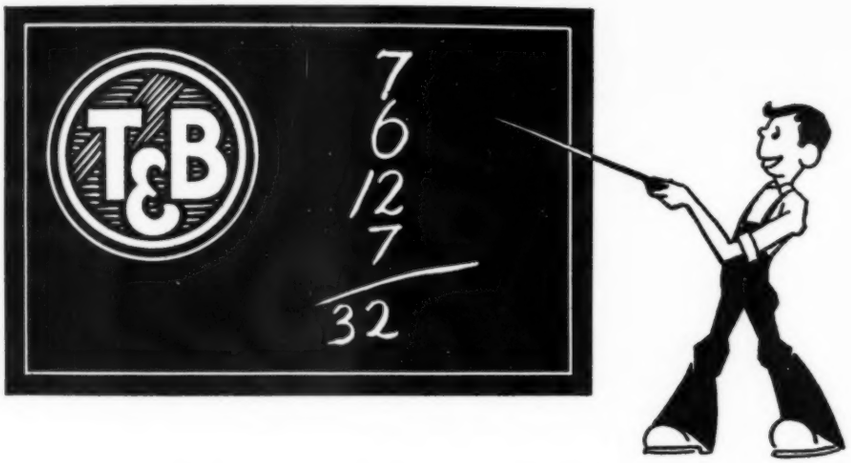




America's whole defense program hinges on electrical preparedness. Production can be increased only as fast and as far as electrical facilities permit. Hundreds of plants must be re-equipped electrically before they can be brought to the peak levels of output and efficiency that the times require.

In this program, it's *your* responsibility to see that electrical installations in the plants of your customers and prospects are equal to the job ahead . . . to drive for adequate wiring, sight-saving lighting, motive power with the necessary capacity, trustworthy control . . . everything it takes to make the electrical system efficient and interruption-proof.

Here, then, is the ammunition you need. The progressive manufacturers mobilized in this special "GRAYBAR" section are ready with up-to-the-minute equipment that will help you *sell* a better job and *do* a better job. And from GRAYBAR, you'll get the *action-service* you need to complete the job on time. Working together — manufacturer . . . distributor . . . contractor — we can put electrical preparedness over the top!

**GET INTO THE LEAD WITH THE GRAYBAR TAG**




# Simple Arithmetic

## —shows how 32 T&B Pressure (Solderless) Connectors take the place of X-thousand odd styles and sizes formerly needed

The Utmost in Simplification as produced by T & B Engineers.

**LOCKTITE LUG**
7 take *all* cable sizes #4 to 1,000,000 CM.. **7**

**LOCKTITE TAP**
6 tap *all* mains 1/0 to 500,000 CM to all branches #2 to 500,000 CM..... **6**

**HINJON JUNIOR**
12 tap *all* mains #8 to 1,000,000 CM to all branches #14 to #1. Solid or stranded..... **12**

**LOCKTITE 2-WAY**
7 make *all* splices #4 to 1,000,000 CM.... **7**

***Added up, they solve 90% of your wiring problems***..... **32**

By comparison this T & B Line makes soldering on the job an expensive, messy and needless performance.

Each of these T & B Pressure Connectors is an engineered product of scientifically *correct leverage pressures.*

Installed in a few seconds, they hold fast for all time. Defy vibrations. Approved by the Underwriters. Accepted by leading Contractors, Defense Program Authorities and Industrials from coast to coast.

Stocked and sold by Graybar and other T & B Distributors who enjoy protection under The T & B Plan which guarantees a 100%-Distributor, One-Price Policy, with no private deals, weird bookkeeping or exceptions of any sort.

Send for catalog and convincing samples.

## The Thomas & Betts Co., Inc.

*Manufacturers of Electrical Fittings, of which T & B Pressure (Solderless) Connectors are but one line.*

**ELIZABETH, N. J.**

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Graybar Everything Electrical Graybar Electric Company

for

# PRODUCTION
# PROTECTION
# PREPAREDNESS

## plus Profit

## go underground . . . with ORANGEBURG

There's one simple and certain way to insure the continuity of electric service so requisite to uninterrupted plant production. That's to go underground—with Orangeburg Conduit.

For Orangeburg offers *complete* cable protection. Not only is it immune to corrosion in itself, but it has water-tight joints. Ground moistures, whether acid or alkaline, cannot reach and ruin the cable sheath.

And—the installation of Orangeburg is one step in a practical preparedness program that need be taken but once. This conduit is essentially everlasting—its protection practically permanent.

Finally—and financially—there's *extra* profit for *every* contractor in *every* foot of Orangeburg Standard or Nocrete Conduit. It not only costs less, handles easier, assembles and installs faster, but is easy to get from any branch of our sales agents.

**Nocrete**

*Try it now, for anything from an industrial power, lighting or signal service, to a house connection, garage or barn hook-up! NOCRETE is built for installation underground without concrete encasement.*

**Standard**

*For a duct-bank job, a downtown or heavy-traffic location, use Orangeburg Standard installed with concrete encasement, and your profit margin will be assured.*

MADE AT ORANGEBURG, NEW YORK
BY THE FIBRE CONDUIT COMPANY,
292 MADISON AVENUE, NEW YORK CITY

SALES AGENTS
GRAYBAR ELECTRIC COMPANY, INC.

# ORANGEBURG

NOCRETE for installation without concrete encasement
STANDARD for installation with concrete encasement

GraybaR QUALITY — Distributed and guaranteed by GraybaR ELECTRIC COMPANY

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WITH THE GRAYBAR TAG

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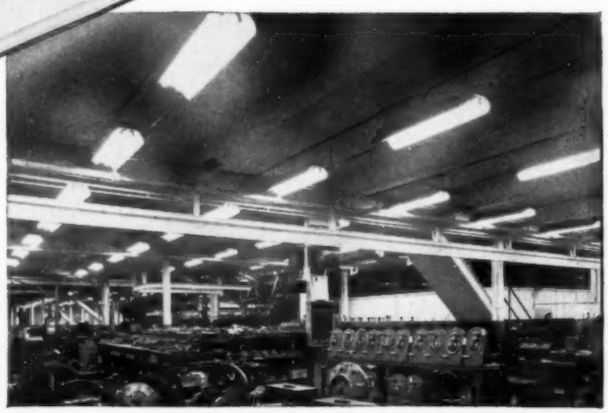
# FLUORESCENT LIGHTING FOR INDUSTRIAL...

Day Brite "TWO-FORTY" FLUORESCENT INDUSTRIAL FIXTURE



For two 48" 40-watt lamps. Complete with sockets, lamp starters, high power-factor ballasts, 6-foot rubber-covered cord and plug. Reflector, porcelain enamel, finished white inside and gray outside. Hood is finished in gray baked wrinkle enamel and is arranged for pipe or chain suspension. Reflector hinged for servicing.

# . . . and COMMERCIAL APPLICATIONS

Day Brite COMMERCIAL FLUORESCENT FIXTURES PARALUME DAY BRITE LIGHTING INC. ST LOUIS

**Illustrating the Three-Light *PARALUME***

For stores and offices of all types. Two finishes . . . satin chromium and Day-Brite "SUPER-WHITE." Cast ends satin and polished finish. For two, three and four 24" and 48" lamps. For direct ceiling and suspension mounting. Wired and include sockets, ballasts and lamp starters.

**Day Brite Lighting Inc.**
5433 Bulwer Ave. St. Louis, Missouri

PRODUCTION PROTECTION PREPAREDNESS

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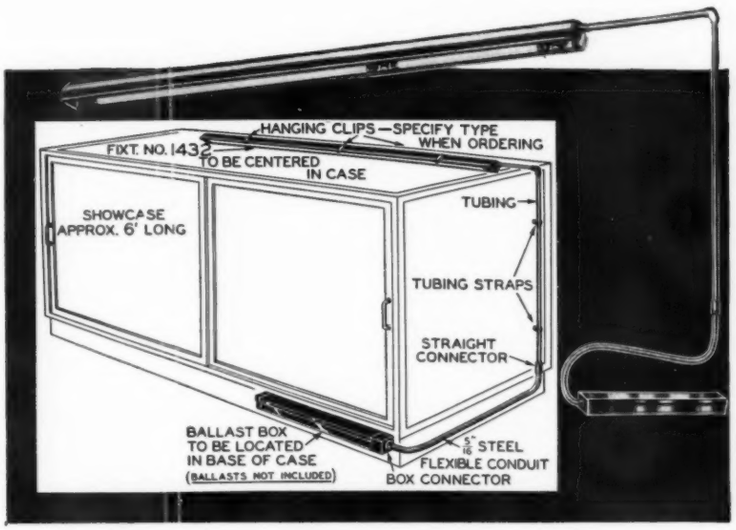
# . . . DISPLAY AND ATTRACTION LIGHTING




## *Complete Standard Showcase Assemblies*

Stock assemblies for 18″ and 36″, T-8 lamps available in combinations of lamp sizes to fit any standard showcase up to 10 feet. These assemblies are furnished wired complete with tubing, fittings and ballast boxes. The reflectors are porcelain enamel and the lamp starters are located in the fixture body.

## *Wallcase Fixtures*

For wallcases, display cases, wall niches, small display windows and similar applications. Available as units for 18″, 24″, 36″ and 48″ fluorescent lamps. Fixtures have porcelain enamel reflectors assuring diffuse reflection and true color rendition. Ballasts and lamp starters are located in fixture body. Two types of fixtures are available — angle cut-off type for medium and deep cases and straight cut-off type for shallow cases.

## *Show Window Reflectors*

Standard Day-Brite reflectors for 2, 3 and 4 lamps . . . 18″, 24″, 36″ and 48″ sizes. Efficient Alzak reflectors. Four-light unit illustrated at right. For smaller installations the unit shown below is available with asymmetric and symmetric Specular Alzak reflectors for one and two 18″, 24″, 36″ and 48″ lamps. All fixtures furnished wired and include sockets, lamp starters and ballasts.

**Manufacturers of "*The Complete Line of Fluorescent Lighting Fixtures*"**

GraybaR Quality — Distributed and guaranteed by GraybaR Electric Company

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WEBSTER ELECTRIC

# Teletalk

REG. U.S. PAT. OFFICE

*Amplified*

***Intercommunication***

# Sells for $49.00 and Up

2 STATIONS $49.00

Above shows a Model 105 and Speaker-Microphone 5A-45. . . . Sketches show additional combinations

3 STATIONS $58.50 — 4 STATIONS $68.00 — 5 STATIONS $77.50 — 6 STATIONS $87.00

*Various combinations of Models and Types at Proportionate Prices*

## It carries a good profit and you make a profit on material and labor, too . . . . There are *thousands* of places to sell it . . . .

Any electrical contractor who is not taking advantage of the rapidly increasing interest in amplified intercommunication is just simply passing up a whale of a lot of very profitable business.

If you are a contractor who thinks of Teletalk only as high priced equipment that can be sold only to large industrials, you are mistaken.

Look at the illustration and chart at the right. There are thousands of places you can sell and install the smaller Teletalk systems. Home owners are installing them. Small shops are finding two, three and four station systems to be indispensable. Professional men and small businesses say that Teletalk is saving their time, saving footsteps for their employees and reducing fatigue—in short, simplifying their daily routine to an immeasurable degree. When Teletalk is once installed, satisfaction increases daily. If you don't believe this, try having a demonstration in a prospect's place of business for one week. You'll make a sale—and a profitable one, too, because a Teletalk installation means the sale of wire, conduits, junction boxes as well as labor.

If you want to get some of this profitable business insist upon the full cooperation of your local Graybar house, or, ask us how to show you the easy way to do it.

*Licensed by Electrical Research Products, Inc., under U. S. Patents of American Telephone and Telegraph Company and Western Electric Company, Incorporated*

**WEBSTER ELECTRIC COMPANY, Racine, Wis., U. S. A. Est. 1909. Export Dept.: 100 Varick St., New York City. Cable Address: "ARLAB" New York City**

# Webster Electric

*"Where Quality is a Responsibility and Fair Dealing an Obligation"*

MANUFACTURERS OF TELETALK INTERCOMMUNICATION AND PAGING SYSTEMS • POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT • RADIO PHONOGRAPH PICKUPS • IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNERS

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Graybar — Everything Electrical — Graybar Electric Company

# Specify "Hubbell"

For over fifty years Harvey Hubbell, Inc. has maintained an established reputation in the design and manufacture of rugged wiring devices that are widely accepted among the building trades as well as by industry.

# HUBBELL *Rugged* WIRING DEVICES

## — FOR —

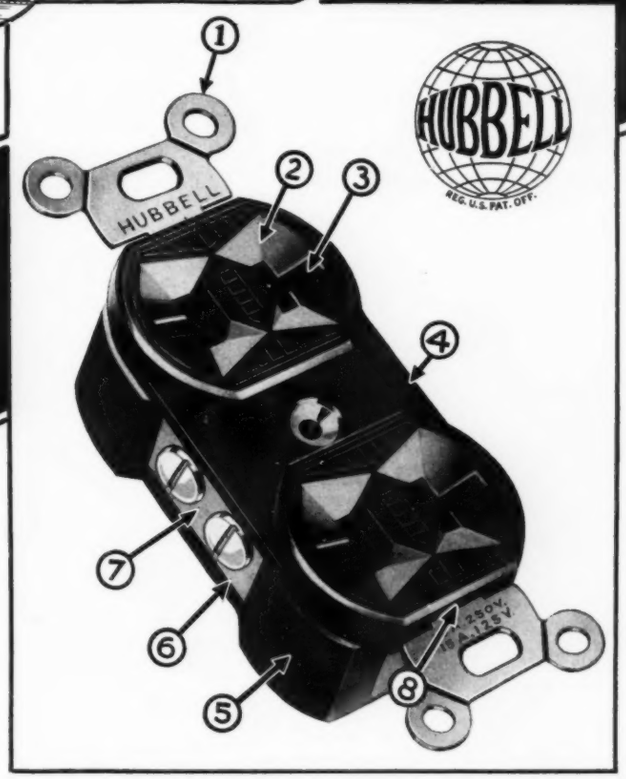
## PUBLIC BUILDINGS — HOMES AND INDUSTRIAL PLANTS

Hubbell Wiring Devices provide convenience, comfort and safety in the operation of electrical appliances and devices.

COMPLIES WITH FEDERAL SPECIFICATION No. W-R-1

## SPECIFICATION GRADE 9595 CONVENIENCE OUTLET

Extra heavy PHOSPHOR BRONZE CONTACT SPRINGS grip cap blades on two sides. Two large binding screws on each side provide for two No. 10 wires.




1. Washer Type Mounting Ears available for "building up" when broken off.
2. Bakelite Face with Special Slot-finding feature.
3. Double "T" Slots takes any plug.
4. Bakelite Barrier Bridge over binding screws insulates the wiring cavity.
5. Solid Composition Body prevents moisture absorption.
6. Deep Wiring Pockets.
7. Four Binding Screw Type; Extra large heads further apart take 2 No. 10 wires.
8. Cadmium Supporting Bridge is securely locked.

# HARVEY HUBBELL, INC., BRIDGEPORT, CONNECTICUT, U.S.A.

GraybaR QUALITY — Distributed and guaranteed by GraybaR ELECTRIC COMPANY

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PRODUCTION PROTECTION PREPAREDNESS

# The Solution to Any Lighting Problem can be found in the BENJAMIN LINE!

**Here are a few of the many types of lighting units manufactured by BENJAMIN to provide Industry with a properly designed lighting unit for every requirement.**

**By calling these and the many other special BENJAMIN Lighting Reflectors to the attention of industrial managements, the Electrical Contractor can be of real service to his customers.**

### *The Benjamin* RLM STREAM-LITER

A New Two Lamp Unit for General Illumination as well as Localized Lighting. Utilizes the latest developments in Fluorescent Lamps and Auxiliary Equipment to provide economically and efficiently, a new type of general lighting as well as localized lighting. Important features include: 1. Conforms to new RLM Specifications and has RLM Label. 2. 78% Reflection Factor. 3. 72½ degree cut-off angle and shielded ends to shield light from direct view. 4. Total light output efficiency of 78% or more. 5. New type, two lamp auxiliary which corrects for power factor and flicker. 6. Renewable type starter switch located in new type socket. 7. Simplified installation. 8. Underwriters' Label of Approval.

### *The Benjamin* SIGN REFLECTORS

Made of Lifetime BENJAMIN Porcelain Enamel; specially designed to light signs uniformly and brilliantly with a minimum of light spillage beyond the sign; neat and inconspicuous; no interference with the sign's readability day or night; easier and lower cost installation; no conduits to bend; removable reflectors to facilitate inspection and maintenance; finest, high quality material and construction throughout. These are a few of the features that make the BENJAMIN *Rexide* and *Emblem* Sign Reflectors outstanding for better sign lighting and lasting satisfaction. These are just two of the complete line of Sign Reflectors which are made by BENJAMIN for every type of sign lighting problem.

### *The Benjamin* STEEL-LITE

A heavy-duty, extremely rugged lighting unit particularly designed for industry's severest service conditions. Unit is completely armor-clad with a steel housing and a tempered plate glass lens so tough that a 1½ lb. steel ball dropped from a 7 ft. height *CANNOT BREAK IT!* Furnished with polished Alzak aluminum reflector for high mounting or etched Alzak aluminum for spread light distribution in medium mounting. Easier servicing and additional safeguard against breakage is provided by the cover frame, which has an exclusive latch feature; is hinged to the unit and holds glass securely when opened.

### *The Benjamin* ALZO-LITE FLOODLIGHT

A medium spread floodlight especially suited for floodlighting of outdoor play areas such as horseshoe courts, hockey rinks, swimming pools, playgrounds and other outdoor locations such as construction areas, yards, etc.

Made of Alzak aluminum, it is designed for use with 750, 1000, 1500 watt lamps. The reflector can be rotated in hood for easy horizontal positioning. Three types of hood brackets are available for various mounting conditions.

### *The Benjamin* EXPLOSION-PROOF FIXTURES

Listed by Underwriters' Laboratories for Class 1, Group D hazardous locations, atmospheres having vapors of gasoline, naptha, petroleum, alcohol, acetone, lacquer solvents and natural gas. Providing high efficiency and improved quality of illumination, these fixtures have ample strength in every part to withstand the tremendous pressures of internal explosions without breaking down or permitting flame, hot gasses or sparks to escape and ignite surrounding atmosphere. Dome, Shallow Dome, Angle or Bowl reflectors may be attached.

### *The Benjamin* STOCK-BIN-LITE

The STOCK-BIN-LITE provides uniform light distribution from top to bottom and from end to end of stock bins, warehouse aisles, tool rooms, shelving, etc. The deep reflector directs ample light even to bins closest to floor. Special deflector directs light above cutoff and end apertures increase illumination between units. Direct glare from the lamp is reduced by shielding reflector.

**For other lighting problems and their solution see the Benjamin MANUAL OF FACTORY LIGHTING PRACTICE and other Benjamin Data Bulletins available upon request. Benjamin Electric Mfg. Co. Dept. H, Des Plaines, Illinois.**

## IT'S A BANNER DAY FOR ELECTRICAL CONTRACTORS

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Graybar Everything Electrical Graybar Electric Company

# "WE SPIKED NEEDLESS SHUTDOWNS FOR THE SOUTHERN CALIFORNIA FISH CO.— with BUSS FUSES"

**SAYS—** R. J. Gatlin, Manager of Gatlin & Co., Electrical Contractors of Wilmington, Cal. "We were getting repeated calls from Southern California Fish Co. to replace the fuses in the main power switch. The fuses were 600 amp. 250 volt size and were blowing out on an average of once a month.

"We checked switch and motors and the entire circuits but could not prevent the fuses from heating excessively and blowing needlessly.

"Finally we decided to see if there was anything to the claim that BUSS Super-Lag Fuses would eliminate needless blows.

"On May 27th, 1935 we removed the old fuses and replaced them with BUSS Super-Lag Fuses. To date not a single needless blow has occurred."

## DON'T LET OTHERS GET THE JUMP ON YOU WHEN IT COMES TO MONEY SAVING IDEAS

If needless blows are causing shutdowns, why not be the first to recognize the service BUSS Super-Lag fuses can give you?

Needless blows caused by heating from poor contact have practically been eliminated in BUSS Super-Lag fuses by a Fuse-Case design worked out through years of laboratory and actual field tests.

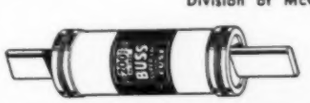
. . . and BUSS Super-Lag fuses have a time-lag feature that really does go a long way towards solving the shutdown problem when the shutdowns are being caused by fuses blowing on temporary or momentary overcurrents.

That's why users of BUSS fuses enjoy a freedom from costly interruptions of electrical service that formerly were so often a burden upon the shoulders of the executives in charge of production or maintenance.

### *How to get action*

Just knowing about BUSS Super-Lag fuses doesn't save any money. So why not get action that means money saving by passing the word along that from now on all fuses installed are to be BUSS Super-Lag fuses?

**Bussmann Mfg. Co., University & Jefferson, St. Louis, Division of McGraw Electric Co.**

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## GET INTO THE LEAD WITH THE GRAYBAR TAG

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PRODUCTION PROTECTION PREPAREDNESS

# EVERSTICK ANCHORS

## SUPERIOR IN HOLDING POWER!

Eversticks provide tight, safe anchoring with holding power always in excess of rated capacities. They have proven their dependability time and time again under the most severe storm and flood conditions. All parts of Everstick Anchors are produced in our own malleable foundry insuring the finest grade certified malleable iron with superior rust-resistant qualities and exceptional toughness.

Ease of handling, storing and installing are features of Eversticks, that engineers and crews appreciate. The Everstick Base Plate with its exclusive nut housing provides a solid, substantial base for the expanding plates.

*A complete line of Eversticks is available for all strain requirements. There are 15 sizes of 2-way, 3-way, 4-way types; also Cone Anchors.*

THE ANCHOR OF MERIT

**EVERSTICK ANCHOR COMPANY, Fairfield, Iowa**

PRODUCTION
PROTECTION
PREPAREDNESS

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GraybaR QUALITY Since 1900 — Everything Electrical — GraybaR ELECTRIC COMPANY

# AND THE GREATEST OF THESE IS MEN

Buckeye Conduit is a combination of fine materials, excellent production equipment, and highly skilled men. And the greatest of these is men!

Anybody can buy machinery and materials but the skill in a man's hands must be built by years of the most painstaking effort -- an effort that must be continuous, untiring, and inspired by ambition and loyalty.

That this is the stuff of which Youngstown's steel makers are made has been recognized by many of our steel mill visitors, who never cease to marvel at the obvious spirit of cooperation that inspires this force. We in the sales department know of it, of course, which is one very important reason why we are proud to offer you Youngstown Buckeye Conduit as a product that is perfectly fitted to your needs.

Ask your distributor for Youngstown Conduit - Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes

26-15C

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

Buckeye Conduit in the new power house, Possum Kingdom Dam, Brazos River, Texas

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

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# DEPENDABILITY *more* IMPORTANT *than ever*

## JEFFERSON E.T.L. CERTIFIED FLUORESCENT LAMP BALLASTS

CERTIFIED E.T.L. SPEC NO 6 HIGH P.F.

UL

All Jefferson Ballasts coming within the scope of the specifications set up by the lamp manufacturers have been certified by Electric Testing Laboratories and are so marked. And all Jefferson Ballasts and manual type switches are listed by Underwriters' Laboratories, Inc., and carry the U. L. Label.

You insure the best fluorescent lamp performance with Jefferson Ballasts. Ask for Bulletin 402-FL.

TO LINE (GRD)
CONNECT OTHER SIDE OF LINE TO OTHER TERMINAL OF NO.2 SOCKET.
TO NO.2 SOCKET
TO NO.1 SOCKET
JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS
TO NO.1 SOCKET

## JEFFERSON *Air-Cooled* POWER CIRCUIT TRANSFORMERS

Wherever power circuits are available in manufacturing plants, mines, warehouses, educational and other institutions, Jefferson Transformers of the power circuit type are desirable for providing low voltage circuits. Available in capacities from 50 VA to 15 KVA—230, 460 and 575 volt primaries—115 and 230 volt secondaries.

Jefferson Air-Cooled Power Circuit Transformers are designed and built with traditional Jefferson care and thoroughness. They can be relied on for top efficiency and long life. Completely described in Bulletin 401-PCT.

## JEFFERSON-UNION FUSES

**Well-Known Since the Electrical Industry Began**

Union Fuses have had ready acceptance since the earliest days of the electrical industry.

Union Renewable Fuses have proven their quality, uniform accuracy and reliability. They are strong mechanically, and renewing links is a simple, quick operation. Electrical engineers and maintenance men prefer them for their reliability and long years of service.

● **Jefferson Electric Company, for over 25 years, has constantly measured up to changing requirements. Generous provision for research, experiment and engineering is made to insure the satisfactory performance of Jefferson Fluorescent Lamp Ballasts, Fuses, Transformers, and other products.**

**JEFFERSON ELECTRIC COMPANY**

**BELLWOOD, ILLINOIS**

**Canadian Factory:**
**60-84 Oster Ave., W. Toronto, Ontario**

PRODUCTION
PROTECTION
PREPAREDNESS

## IT'S A BANNER DAY FOR ELECTRICAL CONTRACTORS

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# HANDLES MANY JOBS WELL

**• • a fast selling money-maker for busy contractors**

*Versatile*

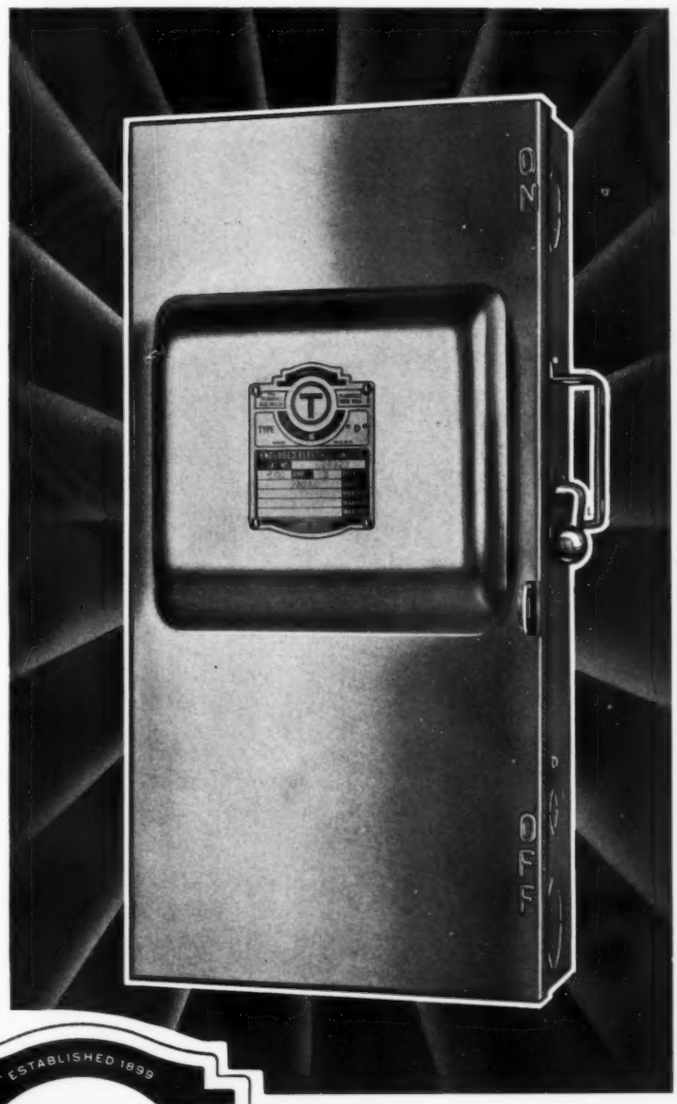
## TRUMBULL

### TYPE "D" Enclosed Switches

Contractors who KNOW the TRUMBULL Type "D" line long since realized that this is one of the most popular and generally useful lines of enclosed switches ever built. But because RIGHT NOW there is a widespread demand for many of Type "D's" most important applications, we call every contractor's special attention to these FACTS:

- This is the **only** line of enclosed switches offering the 30 amp. size with either PLUG or CARTRIDGE fuses.
- The 30 amp. with PLUG FUSES is an ideal, economical control for SMALL MOTORS up to 2 h.p., of which many thousands are being installed today on oil burners, refrigerators and air-conditioning installations, etc.
- Larger size switches are equally good for service entrance, general disconnect services and heavy duty lighting.
- The NEW 60–200 amp. front operated Type "D" is MUCH MORE COMPACT for "close quarters" installations.
- Switches are available in RAIN-TIGHT enclosures.
- All TRUMBULL Type "D" Switches have the handsome new BAKED ALUMINUM finish throughout . . . outside for appearance and durability . . . inside too for light reflection for easy wiring or inspection.

It will pay you to KNOW the Type "D" Line and its applications thoroughly. Write for new Trumbull Type "D" Circular No. 2312.




ESTABLISHED 1899

THE TRUMBULL ELEC. MFG. CO. — PLAINVILLE CONN. U.S.A.

A GENERAL ELECTRIC ORGANIZATION

**TRUMBULLAIDS FOR CONTRACTORS**

The Trumbull Products shown in these advertisements are illustrated, described and listed in the Trumbullist, in individual circulars and in Trumbull "Cheer." Be sure your name is on our lists to receive all of these important TRUMBULLAIDS

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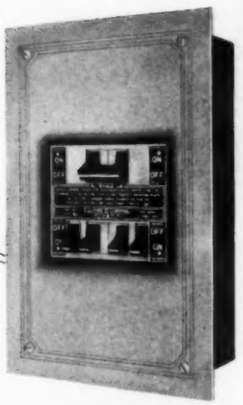
PRODUCTION PROTECTION PREPAREDNESS

# SQUARE D EQUIPMENT FOR EVERY APPLICATION

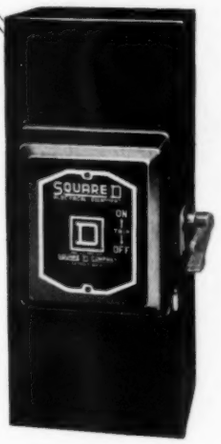
Saflex Panelboard. Power and Lighting



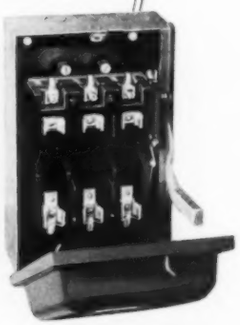
Multi-breakeR Load Center for Controlling Groups of Lighting Circuits

● Square D electrical equipment includes safety switches, range switches, power and lighting panelboards, industrial circuit breakers, Multi-breakeRs, electric motor control and SQUARE-Duct. A complete, quality line for the efficient control and distribution of electric current in the home, on the farm, in commercial buildings and industrial plants.

Multi-breakeR Panelboard—Narrow Column Type



Industrial Circuit Breaker



Type A, Heavy Duty Industrial Safety Switch

Voltage Tester Used on All Voltages (110 to 600) AC or DC

## SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

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...ANSWER PAGE FOR CONVENIENT INQUIRY FORM

Everything Electrical

GraybaR ELECTRIC COMPANY

# WAKEFIELD *Fluorescent Units*

## READY FOR IMMEDIATE DELIVERY

## FROM GRAYBAR STOCKS

THE CAPTAIN, a Certified Fleur-O-Lier using 4—40-watt lamps. Excellent for store lighting. Available only through Graybar.
THE BRIGADIER, a Certified Fleur-O-Lier available for 4 or 6—40-watt tubes.
THE BEACON, a Certified Fleur-O-Lier, uses 4—40-watt lamps. Available only through Graybar.
THE GRENADIER, a Certified Fleur-O-Lier using two 40-watt lamps.





## *They're "Tops" for Commercial Use!*

These new Wakefield fluorescent lighting units have been engineered to give top lighting efficiency . . . amazingly better light for stores, offices or other commercial jobs. They're smart. They're modern. They're all Certified Fleur-O-Liers, checked by Electrical Testing Laboratories. In short, these new Wakefield units provide fluorescent lighting at its best. And especially important to you, Wakefield fluorescent units are *ready for delivery now!* See your Graybar House or write for Wakefield "Bulletin No. 57".

**A real sales help . . . the Brigadier demonstrator**

Here's a complete Brigadier unit ready to hang up and light. Lets you show and measure fluorescent lighting results anywhere in a few minutes. Helpful for determining spacing of units. Packed in a light, sturdy box, with handles for easy carrying.

*See your GRAYBAR house.*

**THE F. W. WAKEFIELD BRASS CO.**

**1100 ECON PARK, VERMILION, OHIO**

Graybar Quality — Distributed and guaranteed by Graybar Electric Company

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# "You bet-I'd rather use

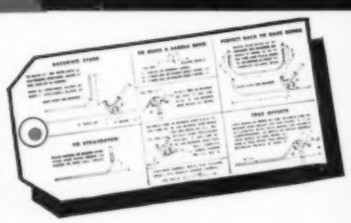
UNDERWRITERS' LABORATORIES, INC. INSPECTED
RIGID
ELECTRUNITE
REG. U.S. PAT. OFF.
STEELTUBES
Z-48
ELECTRICAL METALLIC TUBING

### A NEW LABEL

This new red and black label and the "Inch-Marking" identify genuine ELECTRUNITE STEELTUBES. Look for them on every 10-foot length.

### A NEW BENDER

The new ELECTRUNITE Bender enables you to make bends easier and more accurately than ever before possible. Instructions are built into each bender.



### A NEW BENDING TAG

This new bending tag supplied with each bundle of tubing provides complete simple bending directions and diagrams for making all standard types of bends.

PRODUCTION
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GraybaR
QUALITY
Since 1840
Everything Electrical
GraybaR
ELECTRIC COMPANY

# ...use this 'INCH-MARKED' Tubing!"

Don't take our word for the advantages of "Inch-Marked" ELECTRUNITE STEELTUBES. Let your workmen try it, bend it and cut it under actual conditions on a wiring job. Then let them tell you what they think of it.

Other workmen who have used this "Inch-Marked" electrical metallic tubing would rather use it than ordinary tubing—for these three reasons:

1. The little marks which indicate inches and feet on the tubing provide a continuous foot-rule on every length—reduce the bother of folding and unfolding a pocket rule.
2. It's not necessary to juggle a flat foot-rule against a slippery round tube while trying to hold it steady to make a pencil mark for cutting or bending. The mark already is made—*accurately.*
3. With "Inch-Marked" ELECTRUNITE STEELTUBES and the new ELECTRUNITE Bender, true bends of any standard type or radius can be made with less effort.

Then, here's something more to consider: Because "Inch-Marked" ELECTRUNITE STEELTUBES insures accuracy in cutting and bending—reduces chance for error and eliminates guesswork—it saves material. And when it's practical to prefabricate bends in your shop, the work is easier and the bends always fit.

Use "Inch-Marked" ELECTRUNITE STEELTUBES on your next wiring job—exposed, concealed or in concrete. Check the results and see what a world of difference a few "Inch-Marks" make. Steel and Tubes Division, Republic Steel Corporation, Cleveland, Ohio.

## "INCH-MARKED" ELECTRUNITE Steeltubes*

PAT. APPLIED FOR

REG. U. S. PAT. OFF.

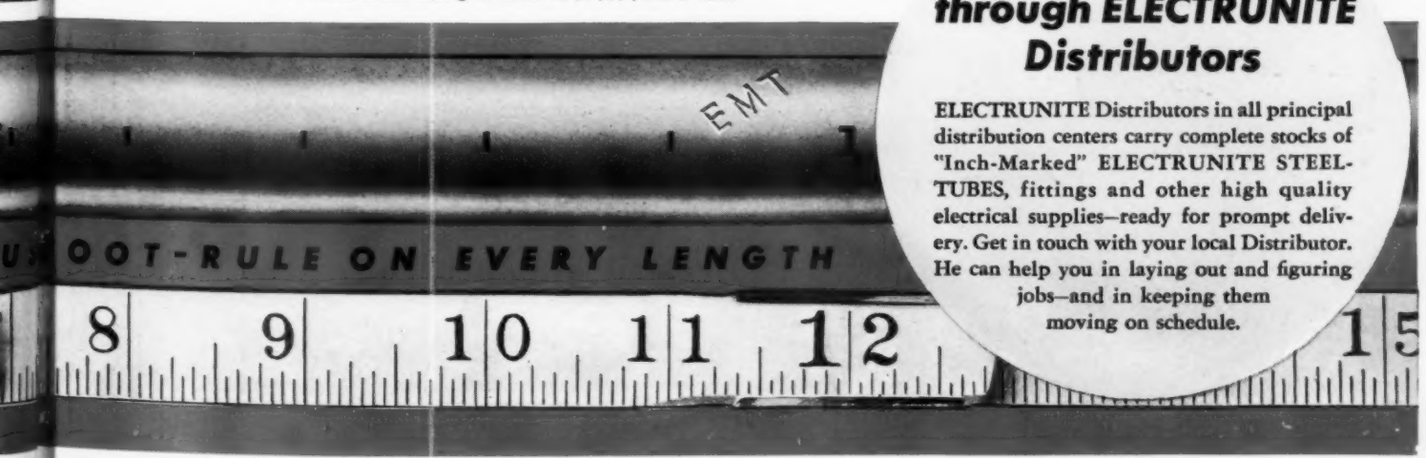
*"Inch-Marked" tubing available in ½", ¾", and 1" sizes.

REG. U. S. PAT. OFF.

REPUBLIC STEEL

**Sold exclusively through ELECTRUNITE Distributors**

ELECTRUNITE Distributors in all principal distribution centers carry complete stocks of "Inch-Marked" ELECTRUNITE STEELTUBES, fittings and other high quality electrical supplies—ready for prompt delivery. Get in touch with your local Distributor. He can help you in laying out and figuring jobs—and in keeping them moving on schedule.

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PRODUCTION PROTECTION PREPAREDNESS

# PREPARED TO PROTECT PRODUCTION

ADEQUATE WIRING SERVES ... SAVES

## COMPLETE STOCKS...PROMPT SERVICE!

Now, as usual, you can depend on stocks and deliveries of Bryant Superior Wiring Devices. The complete Bryant line meets the requirements of any and all wiring jobs.

Through the Graybar organization you are assured of a never-failing and complete stock of Bryant Wiring Devices.

This teamwork—the complete Bryant line of Superior Wiring Devices available instantly from ample stocks close at hand—means the maintenance of installation schedules which, in turn, protects vital production schedules.

If you haven't the latest Bryant Catalog, write for your copy today.

BRYANT

SUPERIOR WIRING DEVICES

**THE BRYANT ELECTRIC COMPANY • Bridgeport, Connecticut**

***"Every Outlet Deserves a BRYANT Device"***

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GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

# For a better, quicker, and more profitable job . . .

## CHANCE ANCHORS give you more to choose from

With all these Chance Anchors to choose from you have a better chance to pick the most practical, dependable and profitable anchors for every job and to comply with practically any customer specifications.

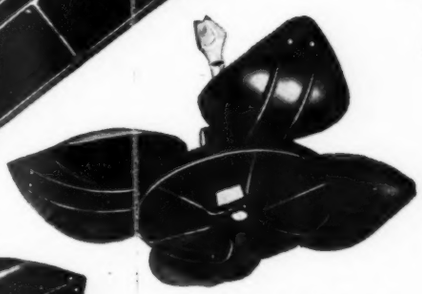
The strength and endurance of any pole line depends fundamentally on the type of anchorage used and the adaptability of the anchors to the soil and guying conditions. Here are your possibilities with Chance Anchors:

- Chance Steel Expanding Anchors—2 and 4 way—6" to 12" diameter—53 to 303 sq. in. expanded—3,000 to 42,000 lb. load. For clay, loam, sand or hardpan.
- Never-Creep Anchors—50 to 400 sq. in.—3,500 to 51,000 lb. load. For clay, loam, sand or hardpan and some rocky soil.
- Wej-Lock Malleable Expanding anchors—3 and 4 way—4" to 10" diameter—70 to 202 sq. in. expanded—5,000 to 40,000 lb. load. For clay, loam, sand or hardpan.
- Expanding Rock Anchor—1¼" and 1¾" diameter—15" to 53" rod length. For solid rock.
- Chance Pyramid Cone Anchors—37 to 467 sq. in.—4,000 to 32,000 lb. load. For rocky or sandy soil and some hardpan.
- Swamp Screw Anchors—8" to 15" diameter—4,000 to 11,000 lb. load. For Swamp land.
- Wrench type Screw Anchors—6" to 10" diameter—2,500 to 10,000 lb. load. For clay and loam.
- No-Wrench Screw Anchors—4" to 10" diameter—1,000 to 12,000 lb. load. For clay and loam.

You'll get prompt delivery from Graybar.

STEEL EXPANDING ANCHORS 2 & 4 WAY

NEVER-CREEP ANCHORS



WEJ-LOCK MALLEABLE 3 & 4 WAY EXPANDING ANCHORS

EXPANDING ROCK ANCHORS

CONE ANCHORS

SWAMP SCREW ANCHORS

WRENCH TYPE SCREW ANCHORS

NO-WRENCH SCREW ANCHORS

PERMA-GRIP TAP CLAMPS

GRIP-ALL CLAMP STICK

ECONOMY TAP CLAMPS

## TIPS TAP CLAMPS for all hot-tap requirements

You'll be doing a better job when you use these eye screw tap clamps for all tap connections because you'll be building for the future—making allowances for changes without service interruptions.

The complete range of sizes available in Tips Perma-Grip Tap Clamps gives you everything you need for a variety of jobs. When price enters the picture the Tips Economy Clamp will get the business and give complete satisfaction. Write for details or ask the Graybar man.

ABC INDUSTRIES

TIPS TOOLS

GRAYBAR QUALITY

Distributed and guaranteed by GRAYBAR ELECTRIC COMPANY

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PRODUCTION PROTECTION PREPAREDNESS

# SERVICE...

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## FOR ELECTRICAL CONTRACTORS

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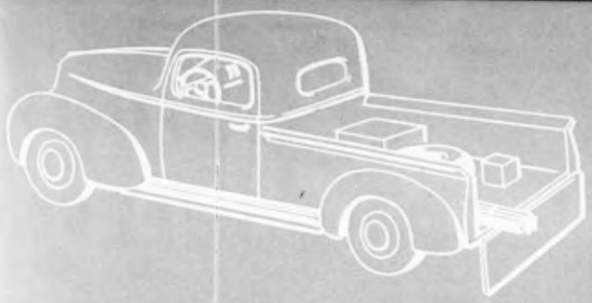
GraybaR QUALITY SINCE 1900
Everything Electrical
GraybaR ELECTRIC COMPANY



# . . . and still more SERVICE!

**National Electric materials melt into the job without those interferences and time lapses which add up into lost profits.**

**And from your local National Electric distributor you will get the delivery service you need to complete your job on time.**

National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.
*Quality Products since 1905*

Graybar QUALITY
*Distributed and guaranteed by*
Graybar ELECTRIC COMPANY

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# THE EASY WAY ... to Sustain EXACTING PRODUCTION SCHEDULES!

**The WESTON multi-range AC Clamp-Ammeter**

Available in three models . . . each having six individual full scale ranges . . . to suit all maintenance applications. Has convenient 6 position range changing switch. Well insulated for protection. Can be used with insulated or non-insulated conductors up to 2" diameter.

**WESTON Model 703 Sightmeter**

Available equipped with the stable, all-glass WESTON perfected VISCOR filter . . . for measuring fluorescent, incandescent, neon, and all other light sources direct, without correction factors.

**WESTON Model 785 Industrial Circuit Tester**

A compact, self-contained unit which provides all the ranges (27 in all) necessary for voltage, current and resistance measurements wherever high sensitivity is a factor . . . including signal systems, telephone circuits, sensitive relay circuits, photo-cell circuits, PA systems and amplifiers, etc., etc.

No longer is it necessary to interrupt a circuit and stop production while motors and machines are being tested. With the WESTON AC Clamp-Ammeter you do your testing with all machinery "on the line". The jaws of this compact maintenance tool are just hooked around the conductor or switch-blade, and you get your current reading. So simple, each test takes but a fraction of the time ordinarily required. Thus you save testing time and save working time, while safeguarding against equipment break-downs and costly power losses. *It's an essential tool for any shop faced with an exacting production schedule.*

And for the assembly line, the inspection department, or for other test requirements, there are WESTON instruments specifically designed to do the job quicker, simpler, and with true WESTON dependability. Make sure you are getting all the benefits of modern WESTON instrumentation. Weston Electrical Instrument Corp., 672 Frelinghuysen Avenue, Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

# WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

***FOR OVER 52 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS***

PRODUCTION PROTECTION PREPAREDNESS

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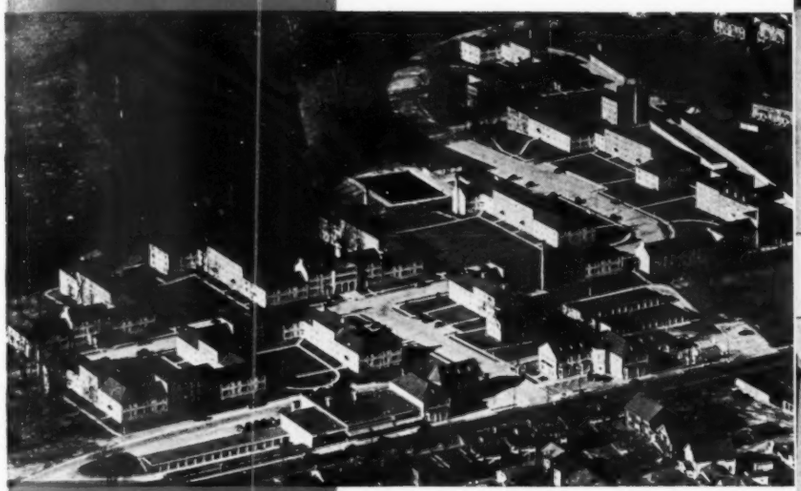
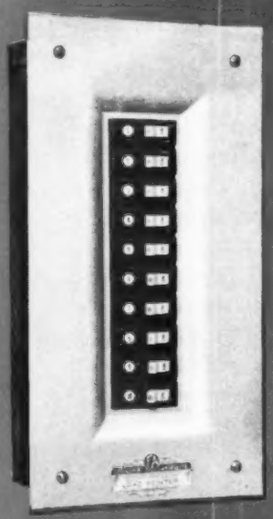
Everything Electrical

GraybaR ELECTRIC COMPANY

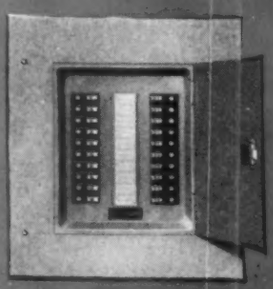
Olentangy Village
COLUMBUS, OHIO

*FA Panelboards and Load Centers afford modern protection to the occupants in this group of beautiful buildings . . . At right: FA Load Center, with range circuit and two lighting circuits, is conveniently accessible above the range*





*FA Load Center — with 10 Single Pole FA AC Circuit Breaker Branch Circuits*



*FA Type NAC1B Circuit Breaker Panelboard, for Alternating Current service only.*

# If you could get them for nothing .... which would you choose?

. . . a moderately-priced FA Panelboard, *made better than necessary*, which would give the owner good service over a long period of time . . . or a panelboard which might work satisfactorily for awhile, and then require constant attention? . . . The answer is obvious . . . Isn't it logical, then, to recommend and install FA Panelboards on all your jobs?

**FA Branch Circuit Breaker Controls require 33⅓% less space than is needed for switch and fuse type branches.**

That means 50% more circuits in the same cabinet space. And the question of space must be considered in new construction as well as in modernization, where the new thin-wall wiring makes possible a greater number of circuits in a given space.

## FA Panelboards, Load Centers and Service Equipment

are completely standardized, with units interchangeable as to capacities . . . They afford *modern protection* and convenience in operation; service is restored quickly . . . They prevent needless circuit interruptions when momentary overloads occur . . . When modernizing, it is rarely necessary to tear out the old panelboard box to make the installation . . . Manufactured on a quantity basis, they are reasonably priced; upkeep is negligible . . . Capacities: 15 to 50 amp., inclusive — single and double pole — 120 volts AC . . . Approved by Underwriters' Laboratories . . . .

**Write for New Catalog No. 56**

and for Bulletins 57 and 60, containing full details, suggested specifications, etc. . . . Frank Adam Electric Company, St. Louis, Mo.

ESTD. 1891
THE SIGN OF A FA BETTER JOB
Frank Adam
SERVICE EQUIPMENT
AC Circuit Breaker Type
FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

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Distributed and guaranteed by
GraybaR ELECTRIC COMPANY

GET INTO THE LEAD
WITH THE GRAYBAR TAG

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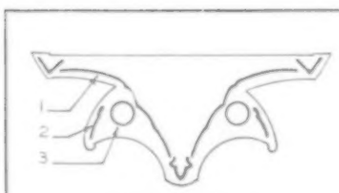
PRODUCTION
PROTECTION
PREPAREDNESS

# SKYLUX
## FLUORESCENT LUMINAIRES

SkyLux luminaires, manufactured by Curtis, and distributed by Graybar, will help you sell the big jobs, the substantial jobs, those with profit in them for you and satisfaction in them for your customers.

SkyLux luminaires are one of many Curtis lines handled by Graybar. Whenever you buy Curtis incandescent or fluorescent lighting fixtures and CurtiStrip wiring channel you can be sure of the best quality material, skillful engineering, and tailored, modern design.

Your Graybar salesman has all the facts on Curtis SkyLux Luminaires, Fluorescent CurtiStrip, "Eye-Comfort" Incandescent Luminaires and Curtis "X-Ray" Reflectors for show window lighting and recessed lighting. Please ask him for this information.




**TWIN SKYLUX**

1. FLURACITE REFLECTOR
2. LAMP SHIELD
3. FLUORESCENT LAMP (Not supplied)

**CERTIFIED FLEUR-O-LIER**

**Curtis Lighting**

1123 West Jackson Blvd.

NEW YORK CHICAGO TORONTO

**IT'S A BANNER DAY FOR ELECTRICAL CONTRACTORS**

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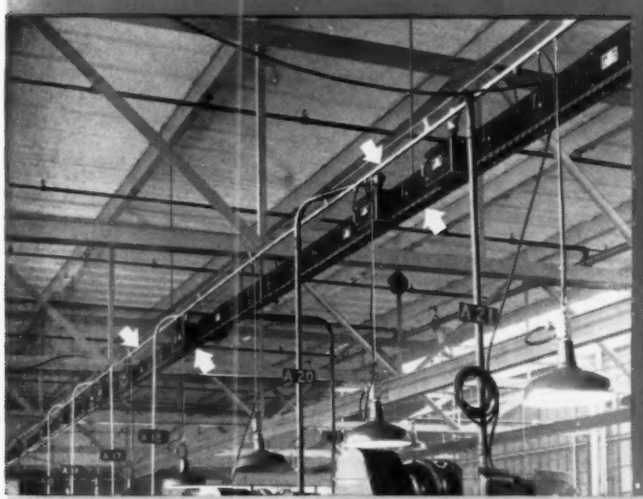
Graybar Everything Electrical Graybar Electric Company

# UNDER THE URGE for GREATER SPEED of INSTALLATION and FLEXIBILITY of CIRCUITS, INDUSTRY is CALLING for FLEXIBLE "Plug-in" BUS SYSTEMS of Distribution



Bull Dog BUStribution DUCT is a pre-fabricated Busbar System for both Main and Branch Circuit Distribution. It can be quickly erected on the job and Branch Circuit Devices "plugged-in" at the most convenient points in the Duct run. New power circuits may be added to the system at any time . . . or old circuits can be quickly and easily moved to new machine locations. It is a flexible, mobile power distribution system that can be kept MODERN—always.

Bull Dog Universal Trol-E-Duct is a mobile pre-fabricated Busbar System for flexible Lighting. By the use of Trolleys or Plugs, all types of lighting fixtures can be readily inserted at any point in the Duct and moved to the most convenient locations to secure the best general or local lighting. New types of lighting units as marketed can be used with Trol-E-Duct without re-wiring. With TROL-E-DUCT you have a Lighting System that can always be kept adequate and MODERN.

*The Installed Cost of a Modern Flexible* **BUStribution SYSTEM** *is usually no greater than for old style fixed inadequate methods.*

**IN ADDITION TO INDUSTRY'S INTEREST IN "PLUG-IN" BUS SYSTEMS OF ELECTRICAL DISTRIBUTION BECAUSE OF ITS SPEED OF INSTALLATION AND FLEXIBILITY IN OPERATION—THE DERATING OF THE LARGER SIZE CABLES UNDER THE NEW 1940 CODE, STILL FURTHER EMPHASIZES THE ADVANTAGES OF A BUStribution SYSTEM AND THE NECESSITY FOR BECOMING FAMILIAR WITH THIS MODERN, MOBILE, FLEXIBLE METHOD OF ELECTRICAL DISTRIBUTION.**

*Write for Bulletins 403 and 386 containing factual information on Layouts, Methods of Estimating, Symbols for Estimators, etc., etc., on BUStribution DUCT for Flexible Light and Power Circuits.*

Originators of Flexible Electrical Plug-in Bus Systems

## BULL DOG ELECTRIC PRODUCTS CO.

DETROIT, MICHIGAN

*Bull Dog Electric Products of Canada, Ltd., Toronto*

MANUFACTURERS OF Vacu-Break Safety Switches. Panelboards. Switchboards. Duct Systems—FOR LIGHT & POWER

GraybaR Distributed and guaranteed by GraybaR ELECTRIC COMPANY

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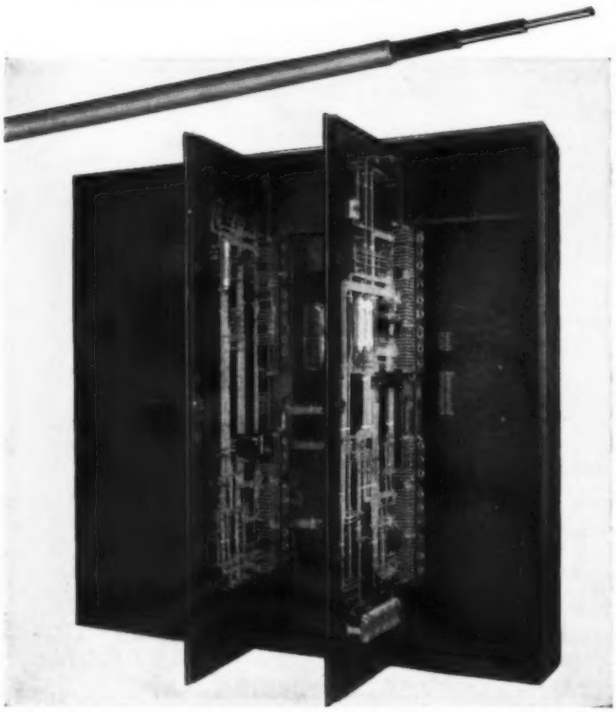
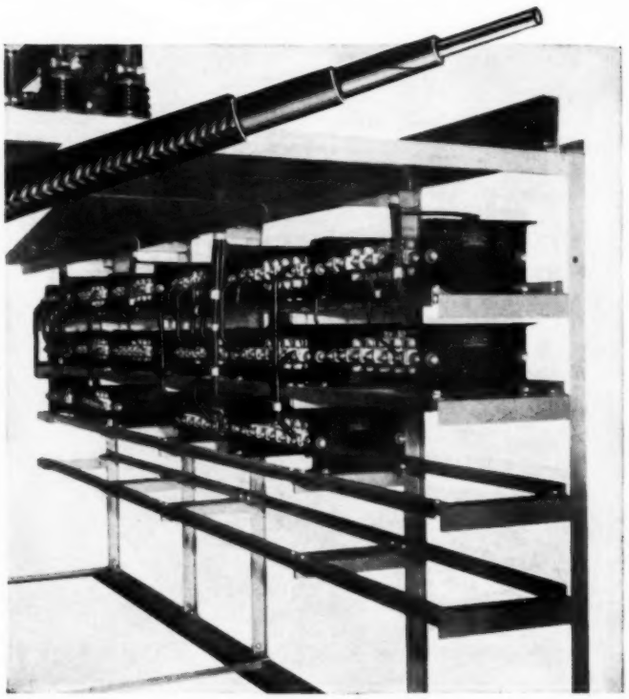
PRODUCTION PROTECTION PREPAREDNESS

# WIRES AND CABLES BUILT TO HANDLE SPECIALIZED JOBS

## *YOU'LL FIND THEM IN THE G-E DELTABESTON LINE*



**DELTABESTON SWITCHBOARD WIRE**
Won't burn—Waterproof—Extremely flexible—Cuts wiring time—Facilitates installation due to smaller over-all diameter—High dielectric strength due to synthetic insulation—Takes sharp bends easily, without harm to insulation.



**DELTABESTON RESISTOR CABLE**
Outstanding heat resistance—Easy to work with—Tinned copper conductor—Felted, asbestos insulation, flame-, heat-, moisture-resisting—Tough asbestos outer braid.

**DELTABESTON FIXTURE WIRE** Highly purified asbestos sheath "felted" on to flexible copper conductor—Great resistance to high temperatures in hot sockets and pendants—Hot wax impregnation for moisture resistance—Polished wax surface for easy pulling—Easy stripping—Uniform diameters.

**Deltabeston Power Cable** Easy to work with—Great resistance to heat, flame, moisture, oil, caustic substances, and abrasion.

Deltabeston Wires and Cables are sold by the Graybar Electric Company and by all General Electric Merchandise Distributors.

Why don't you send for your copy of the complete Deltabeston Catalog? Use the coupon on the last page of this insert.

**GENERAL ELECTRIC**

**IT'S A BANNER DAY FOR ELECTRICAL CONTRACTORS**

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Graybar Everything Electrical
Graybar ELECTRIC COMPANY

★ AS AMERICA SPEEDS-UP NATIONAL DEFENSE ★

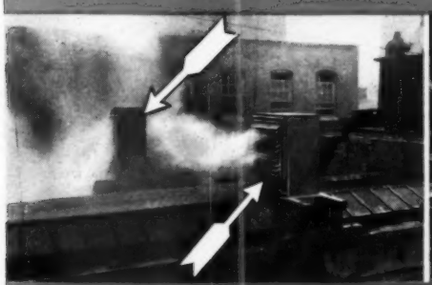
# MAKE BUILDINGS "Breathe" WITH ILG VENTILATION

As American wheels of industry gather momentum, "Vitalized" Ventilation becomes *vitally* important, all the way from front office to shipping room. For when buildings "breathe" properly, employee-employer relations improve . . . health standards rise . . . production becomes more efficient . . . accidents decrease . . . costs go down . . . profits go UP!

**OFFICES** — Air *change*, not just air *movement*, checks that "3 o'clock slump", minimizes errors, avoids open window drafts and arguments.

**TOILETS** — Drive out odors, don't cover them up! A 2-minute air change with an ILG Fan in the window is the answer.

**PAINT SPRAY**—requires rapid air change to workmen and reducing dangers of explosion.



**STEAM AND FUMES** — hinder workmen, cut down visibility, cause depreciation from condensation. Remove them the ILG way!

**DUST** — can quickly be harnessed with an ILG Fan or Blower to clear the atmosphere and prevent silicosis or other allied ailments.

**HEAT** — in excessive quantities near furnaces, ovens, etc., quickly saps vitality. For positive relief, check with ILG!

## SELF-COOLED MIRACLE MOTOR NEVER "Gums-Up"

By drawing clean, fresh, cool air from OUTSIDE the building, circulating it through the motor, then exhausting it, your ILG motor stays clean, cools itself — it's never reached by penetrating grease, smoke or fumes to interrupt service, shorten its life. It actually gives you all the protection of a closed motor, all the operating economy of an open motor! And it's built solely and specifically *by* ILG *for* ILG Fans, Blowers and Unit Heaters! Combine this amazing motor with ILG's rugged framework and dynamically balanced fan wheels and you have the reasons for the quiet, smooth, effortless, efficient operation built into every ILG product. If you are faced with a ventilating or heating problem, write, wire or phone today.

ILG

*Vitalized* VENTILATION

AND AIR CONDITIONING

★AIR CHANGE...NOT JUST AIR MOVEMENT!

**ILG ELECTRIC VENTILATING CO.** 3131 N. CRAWFORD AVE., CHICAGO, ILL. OFFICES IN 45 PRINCIPAL CITIES

PROPELLER FANS • UNIVERSAL BLOWERS • UNIT HEATERS • KITCHEN VENTILATING FANS • HOUSE-COOLING FANS

GraybaR QUALITY

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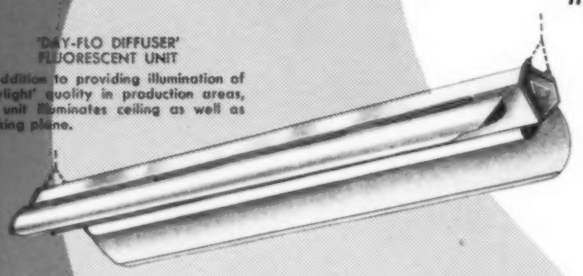
PRODUCTION PROTECTION PREPAREDNESS

# Fluorescent Light – BY Wheeler... FOR INDUSTRY'S STEPPED-UP DEFENCE PROGRAM

'DAY-FLO' FLUORESCENT LIGHTING UNIT
New Two-Lamp Unit (40 watts each); provides general illumination of 'Daylight' quality in industrial locations.

'DAY-FLO DIFFUSER' FLUORESCENT UNIT
In addition to providing illumination of 'Daylight' quality in production areas, this unit illuminates ceiling as well as working plane.



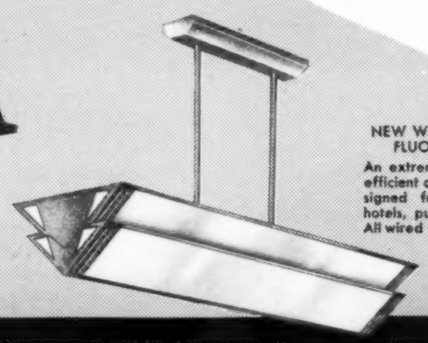
VAPOR-PROOF FLUORESCENT LAMP UNIT
This unit is specially designed for use in food and other plants where it is essential that lamps, sockets and reflecting surfaces be protected from moisture, dust and vapors. Comes complete with hinged dust-tight glass cover.

FLUORESCENT LIGHT — 24 hours a day. Year-round production and operation demand uniform standards of illumination under all working conditions. . . . This is achieved scientifically by the latest developments in Fluorescent lighting that furnishes extremely efficient, cool, unimpaired, 'daylight' illumination *all the time.*

WHEELER-designed and WHEELER-manufactured Fluorescent lighting units . . .

1. Conform to the highest standards of practical lighting efficiency, construction, finish, and reliable performance. All units are easy to install and service.

2. Serve practically every modern lighting requirement, because each WHEELER unit is scientifically designed for a specific purpose which fully satisfies the customer.



NEW WHEELER 'DAY-LUX' FLUORESCENT UNIT
An extremely attractive and efficient commercial unit, designed for offices, stores, hotels, public buildings, etc. All wired and ready to hang.

The WHEELER line includes many styles of units of one- two- or three-lamp constructions, and in 15, 20, 30, or 40 watt lamp sizes. All units are provided with the latest type of high power factor ballast equipment and lamp holders, employing separate and renewable starter switches. Reflector surfaces of Porcelain Enamel, or ALZAK Aluminum, are available.

A complete engineering service, including recommendations, planning, and blueprint layouts, is at your disposal.

# WHEELER REFLECTOR COMPANY

BOSTON . MASS.

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GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

# Ready! FOR ALL WIRING NEEDS

# GENERAL CABLE

**BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE**

Anticipating the greater production that is sure to come with industrial preparedness, it is assuring to know that General Cable is already prepared to meet the increasing demand for quality wires and cables.

*General Cable Corporation Sales Offices:* ATLANTA · BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DETROIT KANSAS CITY (MO.) · LOS ANGELES · NEW YORK · PHILADELPHIA · PITTSBURGH · ROME (N.Y.) · ST. LOUIS · SAN FRANCISCO · SEATTLE · WASHINGTON (D.C.)

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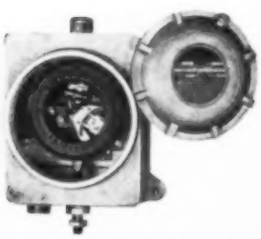
Mercoid Sensatherm, a low voltage thermostat used with all types of automatic heating, air conditioning, refrigeration, etc.

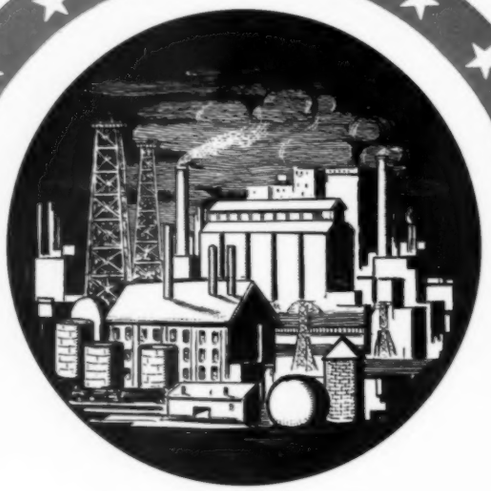
Explosion-Proof Thermostat for industrial room air temperature control in hazardous locations.

Lever Arm Control used to mechanically open and close electric circuits. Adaptable to many kinds of applications.

Pressure Control used as a safety limiting device on steam boilers. Also widely used on many industrial applications.



Pressure Control within explosion-proof case for use in oil refineries, gasoline stations, flour mills. etc.



# SAFETY

## IS INDUSTRY'S FIRST LINE OF DEFENSE

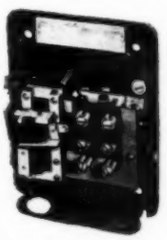
**U. S. Government defense measures are now in full stride. American industry is called upon to meet urgent requirements. Production facilities are going to be taxed to capacity. ¶ Gearing up to a high speed, calls for extra precautions all the way down the line. Here is where Mercoid Automatic Controls play an important role. They stand at guard, offering unfailing protection wherever their services are required. They are standard for all types of industrial applications. ¶ Pressure, vacuum, temperature, liquid level, mechanical operations, electrically operated under Mercoid Controls represent the ultimate in safety. ¶ There are many industrial conditions where explosion-proof control operation precautions are essential. Wherever such conditions prevail, Mercoid Controls in explosion-proof housings are recommended. They are available for various types of control applications. These controls are one of Mercoid's many outstanding contributions to the field of industrial control. ¶ All Mercoid Controls are equipped exclusively with corrosion-proof sealed mercury contact switches, assuring uninterrupted performance and long life. Manufacturers requiring high grade mercury switches will find the Mercoid line measuring up to every exacting requirement. ¶ Consider Mercoid a consultant on any of your control or switch problems. A competent staff of engineers are at your service. ¶ Send for comprehensive Mercoid Catalog, it will prove a valuable addition to your source library.**

THE MERCOID CORPORATION

4202 BELMONT AVENUE • CHICAGO, ILLINOIS

Various types of mercury switches available. Illustration above shows the Magnetic stationary type, mercury switch. Permanent magnet actuates electrode to "open" or "close" the circuit.

Tilting type mercury switch. The internal construction produces a snap-action movement of the mercury, causing a quick "make" and "break" of the circuit.



Transformer-Relay, a low voltage mercury contact relay which also acts as a transformer inducing low voltage (24 volts) on pilot circuit. Various types available for different applications.

Remote Stem Temperature Controls for numerous industrial requirements, such as refrigeration, air conditioning, also for control of liquids and gases.

Explosion-Proof Industrial Liquid Level Controls for use in gasoline service stations, flour mills or where dust or vapors form an explosive mixture with air.

PRODUCTION
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PREPAREDNESS

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Everything Electrical
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ELECTRIC COMPANY

# GraybaR Specials!

## Ask for proof of "plus-value" on these items

Your GRAYBAR Man respects economy-minded business judgment... he's glad to meet up with men who want proof of "plus-value" when they buy. He can supply facts and figures showing the *performance* economy of GRAYBAR-distributed products, and the *service* economy of buying "everything electrical" the GRAYBAR way.

If you're after products that cost the least in terms of long-run satisfaction on the job, you'll find the GRAYBAR Man "talking your language" right from the start. You'll get trustworthy products, prompt service, and frank and competent buying assistance on "everything electrical."

## TAPE

There's hardly a thing that costs so little—relative to the job—yet means so much to good workmanship and sound performance as tape! » » » GRAYBAR offers a complete line of friction and rubber tape, made to its special specifications by the world's largest tape manufacturer. For critical work, VIM gray tape or AMAZON (A.S.T.M.) are the choice of firms whose tape needs call for careful buying. For splicing compound (rubber tape) combining maximum s-t-r-e-t-c-h with high insulating quality, AMAZON tops the field, VICTOR offers unusual value. » » » Whatever the service, there's a plus-value GRAYBAR tape—clean, strong, free from pinholes—ready to meet it. Ask your GRAYBAR Man *what to look for in tape, and why.* Or, if you prefer, write for booklet which tells the story.

## INTER-PHONES

Here's an interior telephone system that adds greatly to operating efficiency in offices, manufacturing plants and other establishments where time-saving work coordination is essential. When inside calls go via GRAYBAR Inter-Phones, the regular telephone service is less frequently "tied-up" . . . a valuable aid to good public relations. » » » GRAYBAR's staff of communication specialists can plan an Inter-Phone system to your present needs, large or small, in such a way that it's easily expanded later on, with no need to scrap equipment. Write for bulletin GB-S-13 for complete details.

***"When the Graybar Man calls, I can nearly always count on hearing about some new product, or some way of making a saving electrically . . ."***

**—said Manager T_____L_____**

**(No. 3 of a series of 10-second quotes from typical Graybar customers.)**

GraybaR QUALITY SINCE 1869 *Everything Electrical* GraybaR ELECTRIC COMPANY

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# These "BANNER FIRMS" are ready!

FRANK ADAM ELECTRIC COMPANY
BENJAMIN ELECTRIC MFG. COMPANY
BRYANT ELECTRIC COMPANY
BULL DOG ELECTRIC PRODUCTS COMPANY
BUSSMANN MFG. COMPANY
A. B. CHANCE COMPANY
CURTIS LIGHTING COMPANY
DAYBRITE LIGHTING, INC.
EVERSTICK ANCHOR COMPANY
FIBRE CONDUIT COMPANY
GENERAL CABLE CORPORATION
GENERAL ELECTRIC COMPANY
HARVEY HUBBELL, INC.
ILG ELECTRIC VENTILATING COMPANY
JEFFERSON ELECTRIC COMPANY
THE MERCOID CORPORATION
NATIONAL ELECTRIC PRODUCTS COMPANY
SQUARE D COMPANY
STEEL & TUBES DIVISION, REPUBLIC STEEL CORP.
THOMAS AND BETTS CO., INC.
THE TRUMBULL ELECTRIC MANUFACTURING CO.
THE F. W. WAKEFIELD BRASS COMPANY
WEBSTER ELECTRIC COMPANY
WESTON ELECTRICAL INSTRUMENT CORPORATION
WHEELER REFLECTOR COMPANY
THE YOUNGSTOWN SHEET & TUBE COMPANY

**GRAYBAR ELECTRIC COMPANY, Inc., Graybar Building, New York**

**Gentlemen: To help us "keep in the lead with the GRAYBAR Tag," please send us further information on items checked:**

- ☐ FRANK ADAM Service Equipment Load Centers and Panelboards — Bulletin No. 60.
- ☐ BENJAMIN Fluorescent Lighting Equipment — Manual on Factory Lighting Practice.
- ☐ BRYANT Electric Wiring Devices—Catalog No. 40.
- ☐ BULL DOG Safety Switches, Panelboards, Switchboards, Circuit Breakers, Distribution Systems.
- ☐ BUSS Super-Lag Fuses—Bulletin RCS.
- ☐ CHANCE Anchors, Guy Fixtures, Tools, Clamps.
- ☐ CURTIS Fluorescent Curtistrip and Fluorescent Skylux Luminaires.
- ☐ DAYBRITE Paralume Fluorescent Lighting Unit — Catalog No. 112.
- ☐ EVERSTICK Expanding and Cone Type Malleable Iron Guy Anchors.
- ☐ FIBRE CONDUIT CO. "Nocrete" and "Standard" Underground Conduit.
- ☐ GENERAL CABLE Electrical Wire and Cable.
- ☐ GENERAL ELECTRIC Deltabeston Wire and Cable.
- ☐ HARVEY HUBBELL Rugged Wiring Devices.
- ☐ ILG Ventilating Fans, Blowers, Unit Heaters.
- ☐ JEFFERSON Fluorescent Lamp Auxiliaries and Ballasts — Bulletin 401 FL.
- ☐ MERCOID Automatic Controls.
- ☐ NATIONAL ELECTRIC Sheraduct Conduit—Useful Dimensional Data.
- ☐ SQUARE D Multi-Breakers, Circuit Breakers, Voltage Testers, Safety Switches.
- ☐ STEEL & TUBES "Inch-Marked" Electrunite Steeltubes and Electrunite Bender.
- ☐ THOMAS AND BETTS Pressure (Solderless) Connectors—Catalog No. 100.
- ☐ TRUMBULL Type D Switches, Feeder Distribution Systems—Buss-Wa, Flex-A-Power, Trolley—Closur.
- ☐ WAKEFIELD Fluorescent Lighting Units
- ☐ WEBSTER Teletalk for plant or office intercommunication.
- ☐ WESTON Clamp-Ammeter, Foot Candle Meter, Electrical Indicating Instruments.
- ☐ WHEELER "Day-Lux" Fluorescent Luminaires and Industrial Fluorescent Units.
- ☐ YOUNGSTOWN Rigid Iron Conduits

Name..... Position.....

Company.....

Street Address.....

City..... State.....

GraybaR

**...makes the cost-saving products of these manufacturers conveniently available to you.**

When you put your needs for "everything electrical" up to GRAYBAR you get the outstanding product lines, along with the "plus-values" of prompt service and the aid of specialists in solving electrical problems. What's more, on everything you buy, there is the extra satisfaction-insurance of the GRAYBAR Tag.

# Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

## Circuit to Barn

**Q.** *"Will you please give me some information on Code ruling and also the approved method of installing the proposed extension which will be described below?*

*"Now what I want to do is—put a line from the house to the barn for a light outlet at the barn. The load on this line probably will not be over 100 watts. It is to be controlled by a switch on the back porch of the house. (Single-pole toggle if this is permitted by the Code and connected in the 'hot' wire of course.) Will it be O.K. to tap onto the line wires in the ceiling outlet on the back porch or will it be necessary to run a separate line from the service switch at the front of the house to a point on the back porch where the control switch for the barn light is to be located? The service switch is of the light duty type, 30 ampere 2-wire, solid neutral, single circuit and is enclosed. There is only one ground on the entire system. This is a driven rod, there being no water piping anywhere near the building. The one ground which runs from the galvanized meter case is, I assume, the ground for the BX used and also for the service wire.*

*"What about protection to the system from lightning which may hit the line down near the barn and thus have to go through the house wiring to ground at the meter. Lightning seems to be very annoying in this vicinity, having struck trees on several occasions in the past few years." R.L.M.*

**A.** The wires for the light in the barn may be tapped from the ceiling outlet on the back porch and a single pole toggle switch may be used to control it. If the switch is exposed to the weather it should be of the weather-proof type but if the porch is enclosed the switch may be of the ordinary type.

The Code does not require that overhead lines between buildings be protected against lightning, and generally other objects, such as, trees, poles, building, etc. higher than the wires.

Approved lightning arresters could be used but probably one of the best ways would be to string a grounded wire about two or three feet or so, above the circuit wires.

## Motor Disconnects

**Q.** *1. "Is a disconnect horsepower rated switch required on a 5 h.p., 220-V, 3 phase motor fed from a distribution cabinet, if the motor circuit is protected by 45 amp. fuses, and the motor control is an automatic starter with motor running protection and push button control." F.E.R.*

**A.** 1. Yes. See Sections 4402 and 4406 and Official Interpretation No. 173 by which we note that a motor of between 2 and 50 h.p. requires a motor rated switch (which must be rated in horsepower) as a disconnect and that a push button controlled starter requires a disconnect ahead of it.

***INDUSTRIAL SPECIALIST** L. Bonnecaze, Jr., of the Best Electric Co., New Orleans, has an organization which, in addition to specializing in industrial construction work, maintains a motor repair shop and an emergency motor service.*

**Q.** *2. "Is disconnect switch required if push button control can be locked open?" F.E.R.*

**A.** 2. Yes, the disconnect is still required unless the automatic starter is an oil switch in which case no disconnect is necessary ahead of it if it can be locked in the "open" position. When the 1940 Code becomes effective the same will apply to a magnetically controlled circuit breaker.

**Q.** *3. "Is disconnect switch required if controller is manually operated instead of magnetically operated? It is understood that controller is within sight of motor." F.E.R.*

**A.** 3. Where the starter is manually operable and opens all ungrounded wires to the motor and is protected by an overcurrent device, a disconnect is not required ahead of it.

**Q.** *4. "Would switch in distribution cabinet act as a disconnect switch?" F.E.R.*

**A.** 4. If the switch in the distribution cabinet is rated in horsepower and is within sight of the controller it could serve as the disconnect.

## Size of Mains

The multi-breaker panel listed below is taken from an actual listing in a catalogue.

Square "D"
Multi-breaker — Type "MB" 3 wire solid neutral 115/230 V. AC.
Solid Mains 70 Amp.
4–15 amp. 2 wire S.N. 115 V. AC.
1–35 amp. 3 wire S.N. 115/230 V. AC.
1–50 amp. 3 wire S. 115/230 V. AC.

This adds up to 115 amps at 230 volts as compared to 70 amp. mains listed above and raises these questions.

**Q.** *1. "What is meant by the term '70 amp.' mains, if not that 70 amps. is the capacity of the main terminal connections or line connections to feed this panel?" D.S.P.*

**A.** 1. The rating given by the circuit breaker manufacturers to the "Mains. 70 Amp. (Max.)" is the maximum demand in amperes which can be used through the circuit breaker panel. It is the ampere capacity of the

# Announcing New G-E CORDX

(G-E 60% TYPE S)

## A GOOD CORD MADE BETTER

NOTHING LIKE IT... ...ON MARKET

Bias cotton wrap between core and jacket makes cord extremely flexible

**CONVINCE YOURSELF!**
**TRY NEW CORDX! TEST IT!**

You'll find it more flexible and easier to strip than any heavy duty cord you've used before. You'll find it reduces cord replacements. Exclusive General Electric design makes these features possible.

For years CORDX has been a leader—the recognized all-rubber cord to use for hard service conditions. The recent changes keep it ahead—make this good cord even better.

The new construction of CORDX employs a bias cotton wrap placed directly over the core and vulcanized into the inner surface of the 60% jacket. This wrap supplies an anti-friction surface between the jacket and the rubber-insulated conductors.

**CONSTRUCTION OF CORDX**

1. Conductors—fine, soft copper—extra flexibility
2. Cotton Separators—prevent corrosive action—relieve strain on copper wires
3. Insulation—special 30% performance grade compound
4. Cotton Fillers—act as cushion for conductors—increase tensile strength
5. Bias Cotton Wrap—provides anti-friction surface between jacket and core—doubles flexing life—reinforces jacket
6. Twine Braid—imbedded in jacket for extra strength—reinforces jacket—resists kinking
7. Outer Jacket—60% pure rubber compound—mold-cured, dense, tough, resists abrasion, crushing, pinching, etc.

For further information about CORDX or for samples see the nearest G-E Merchandise Distributor or write to Section W-0121, Appliance and Merchandise Department, General Electric Co., Bridgeport, Connecticut.

GENERAL ELECTRIC


## Questions on the Code

[FROM PAGE 75]

terminals and the busses from the terminals to the individual breakers.

No circuit breaker panel should be subjected to a demand greater than the maximum ampere rating of the mains, nor should a total actual load greater than the rated capacity of breaker mains be placed upon it. Satisfactory performance under such conditions cannot be expected.

**Q.** *2. "What would be the size of the service entrance conductors necessary to feed this panel? Assume 50 amp. range load, 35 amp. water heater load and 4–15 amp. circuits for two lighting and two convenience outlet circuits; or assume full 100 per cent demand on panel." D.S.P.*

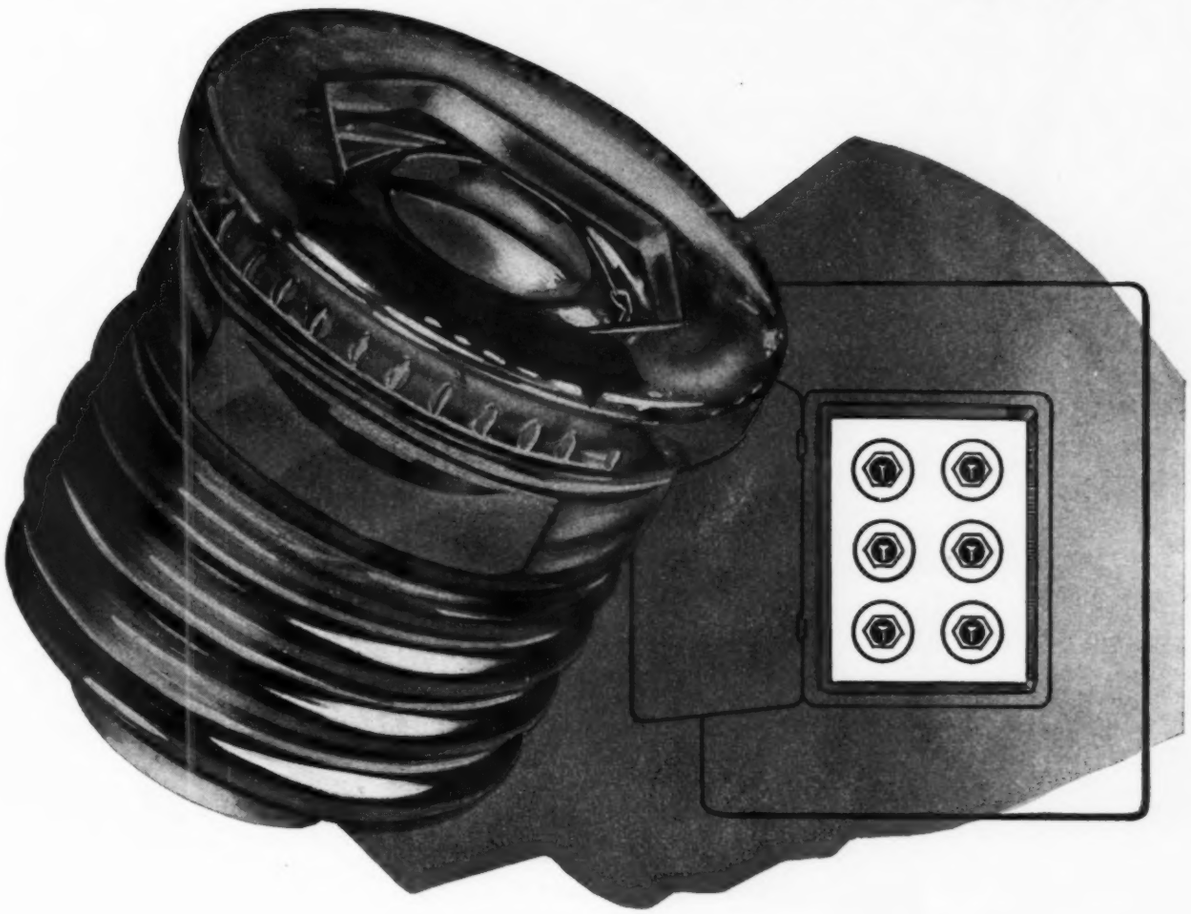
**A.** 2. The size service conductors necessary to supply the indicated load of 115 amperes at 230 volts would be three No. 0 wires. But again let us state that such an actual load should not be placed upon any six circuit multi-breaker panel having a maximum main rating of 70 amperes nor on one of 100 amps. either. Some other arrangement than circuit breakers should be employed for overcurrent protection and for switch control if the demand is to be 100 per cent as indicated.

**Q.** *3. "Would not a 100 per cent demand on this panel require 1/0 R.C. main conductors and 115 amp. mains on multi-breaker?" D.S.P.*

**A.** 3. Yes.

*CREATIVE SELLING is employed by W. A. Stout, Southwestern Electric Co., Oklahoma City, to push fluorescent lighting. His efforts resulted in the sale and installation of 294 units in the past year—real plus business.*

# EVERY OUTLET DESERVES A BRYANT DEVICE



# PLUG FUSES

One of the factory tests which Bryant plug fuses undergo is a dead short circuit at 3,000 amperes. A piece of absorbent cotton is placed over the fuse and this cotton must not be ignited and the fuse must remain intact. . . If you could see one Bryant fuse after another emerge from this short circuit test with the cotton barely discolored, you too would say, "Bryant plug fuses are different." All lines of Bryant plug fuses are approved by Underwriters' Laboratories.

BRYANT

SUPERIOR WIRING DEVICES

*The Bryant Electric Company*
*Bridgeport, Connecticut*

ADEQUATE WIRING SERVES AND SAVES

*SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY*

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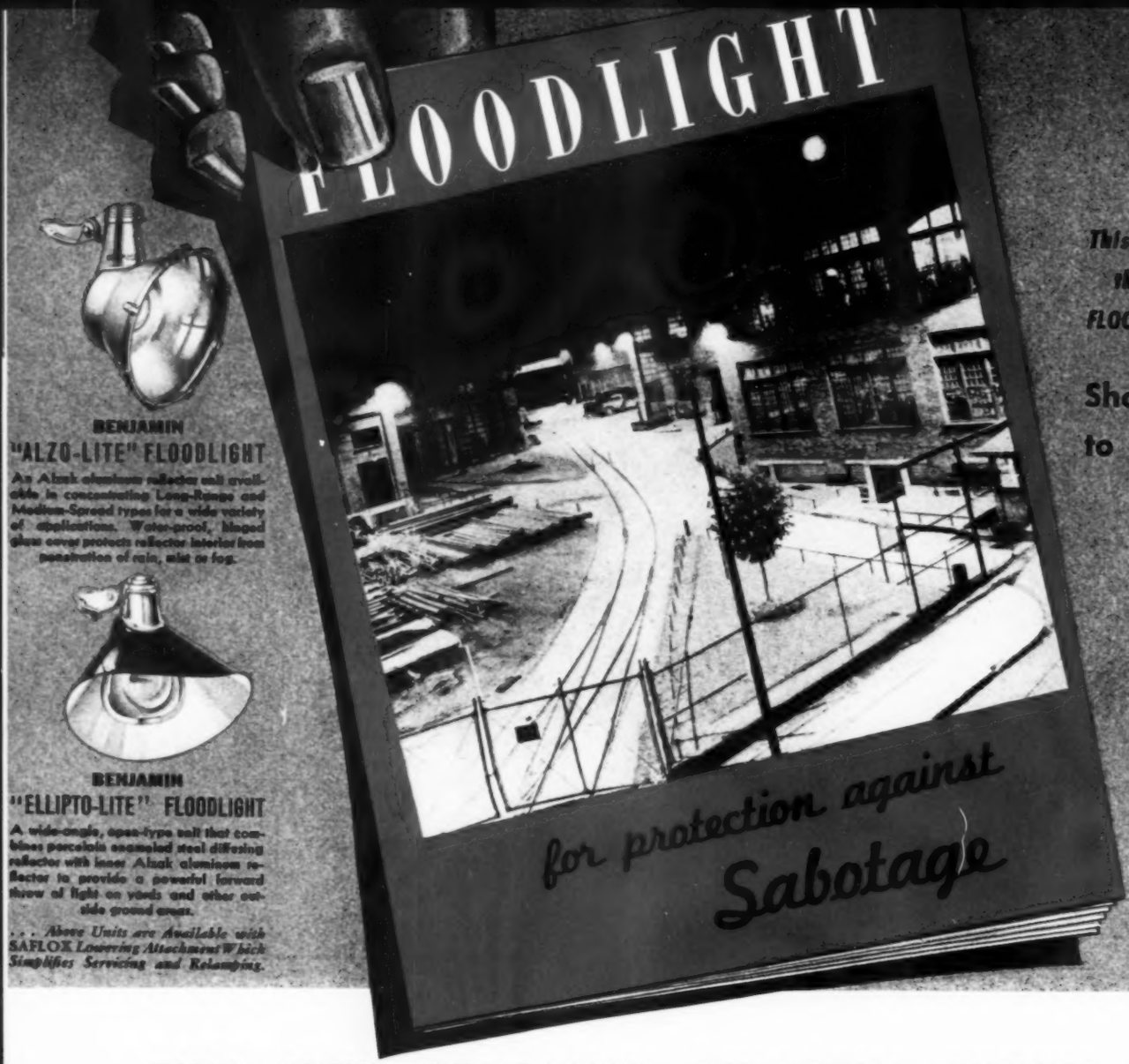




**BENJAMIN**
**"ALZO-LITE" FLOODLIGHT**

An Alzak aluminum reflector unit available in concentrating Long-Range and Medium-Spread types for a wide variety of applications. Water-proof, hinged glass cover protects reflector interior from penetration of rain, mist or fog.



**BENJAMIN**
**"ELLIPTO-LITE" FLOODLIGHT**

A wide-angle, open-type unit that combines porcelain enameled steel diffusing reflector with inner Alzak aluminum reflector to provide a powerful forward throw of light on yards and other outside ground areas.

*. . . Above Units are Available with SAFLOK Lowering Attachment Which Simplifies Servicing and Relamping.*

*This Bulletin Brings You the Answers to Your FLOODLIGHTING PROBLEMS*

**Shows Best Ways to FLOODLIGHT:**

- Fences
- Passageways
- Plant Yards
- Areaways
- Yard Entrances
- Narrow Alleys
- Railroad Sidings
- Outbuildings
- Building Entrances

## THIS NEW BENJAMIN BULLETIN SHOWS HOW TO

# STOP SABOTEURS and INTRUDERS

## *With a* PROTECTIVE FENCE OF LIGHT!

WITH *National Defense* assuming increased importance daily, Industry is relying more than ever on light as a *first line of defense against sabotage and trespass.*

This Manual, "Floodlighting For Protection Against Sabotage", provides you with facts you need to specify floodlighting that prevents production interruptions by outside forces and protects property from trespass and vandalism.

This up-to-the-minute Benjamin Manual includes vital, usable information on: The Need For Protective Floodlighting . . . Lighting Vulnerable Spots . . . How To Use Light . . . How A Protective Lighting System Is Designed . . . etc., etc. It also contains detailed descriptive and installation data on several types of Benjamin Floodlights most widely used in the solution of Industrial Floodlighting Problems.

You may obtain your FREE COPY by simply mailing the Coupon or addressing a letter to: Benjamin Electric Manufacturing Company, Dept. H, Des Plaines, Illinois.

***Mail Coupon Now! . . . FREE BULLETIN . . . Send For It Now!***

**BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois.**

GENTLEMEN: Please send me latest Benjamin Floodlighting Bulletin "FLOODLIGHTING FOR PROTECTION AGAINST SABOTAGE". This does not obligate me in any way.

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**BENJAMIN**
TRADE MARK
**LIGHTING EQUIPMENT**
*Distributed Exclusively Through Electrical Wholesalers*

# Estimating

## WIRING A ONE STORY HOUSE

During the course of wiring a number of small five room one story frame houses in the vicinity of Yonkers, N. Y., the electrical contractor kept a close and accurate record of the labor costs involved. In addition to the five rooms, each house had a bathroom, cellar and garage.

The electrical work included the installation of a 60 ampere, 110-volt, single phase two-wire conduit service with socket type meter equipment and a 60 ampere, two pole main entrance switch. The interior wiring included the installation of a four circuit main lighting distribution panel and a total of 42 outlets consisting of 16 ceiling outlets, 14 receptacles and 12 switches. All interior wiring was done with two- and three-wire No. 14 bx cable.

Here is the labor breakdown:

**SERVICE EQUIPMENT—includes the installation of the conduit service, construction and mounting of the meter board, setting of service switch, meter socket, panel and all connections to same.**
**Total time .....5 m. h.**

**ROUGH WIRING—includes installation of the necessary cable for branch circuits and home runs, setting of all outlet boxes and the necessary wire splices at the outlets.**
**Total time .....10 m. h.**

**FINISHING WORK—includes mounting 16 fixtures and setting and connecting all switches and receptacles.**
**Total time ..... 4 m. h.**
**Total labor for complete electrical work for each house.....19 m. h.**

*Data from Lawrence Electric Co., Yonkers, N. Y.*

## MOUNTING COMMERCIAL FLUORESCENT FIXTURES

The electrical contractor doing work in an industrial office building was called on to install 239 Wheeler Cat. No. 4617 commercial semi-indirect fluorescent units, each equipped with four 40-watt white fluorescent lamps and a two-panel V-shaped diffusing glass enclosure instead of the standard four-panel double tier type. Each fixture when assembled weighed approximately 85 pounds.

The units were shipped unassembled and had to be unpacked, wired and assembled on the job. Each fixture consisted of the following parts:

1—channel iron mounting bar
1—rectangular fixture canopy
2—$\frac{3}{8}$-in. suspension stems
1—fixture body including wiring trough, reactor and starter enclosures, reflector with lamp sockets
2—metal end pieces to hold the glass panels
1—metal tie bar to hold the end pieces rigid and close the bottom of the V glass enclosure.
2—Glass diffusing panels each 52-inches long and 16-inches wide.

Incidental locknuts, bushings, screws and bolts for assembling the fixture.

Commercial fluorescent fixtures are manufactured in a variety of different types. So, to protect himself in estimating for future installations of similar units, the contractor kept a detailed record of the labor required to install these fixtures, from the time they were delivered until they were ready for use. This included unpacking, wiring, mounting, assembling and lamping.

The units were mounted to the fixture studs on the outlet boxes concealed in an acoustical board ceiling 11-feet 6-inches from the floor. The mechanics worked from a plank bridging two "A" ladders standing on a concrete floor. In some instances the ladders and equipment had to be moved to make way for the floor covering contractor. Because of the length and the weight of the units two men were required to mount each fixture.

The following is a breakdown of the labor necessary for the installation of each fixture:

**UNPACKING—includes unpacking each part of the fixture and laying it out for assembly. Two men required.**
**Total time per unit.....0.5 m. h.**

**ASSEMBLY AND MOUNTING—includes wiring the fixture body, assembling ends, tie bar, stems, canopy and mounting and connecting the unit to the outlet. Two men required.**
**Total time per unit.....0.67 m. h.**

**LAMPING—includes the installation of four 40-watt fluorescent lamps and two glass panels in each fixture just prior to occupancy of the room. One man required.**
**Total time per unit.....0.25 m. h.**

**NON-PRODUCTIVE LABOR—includes labor expended in moving equipment and material to cooperate with the other trades and other small tasks that arose due to specific job conditions. This labor unit varies with each different job.**

**Approximate time per unit.....0.25 m. h.**
**Total time per unit, including the approximated non-productive labor .....1.67 m.h.**

*Data from E. J. White Company, Newark, N. J.*

***LARGEST SINGLE** fuse order in history, according to C. R. Wright, Wright, Cason Electric Co., Knoxville, Tenn., was placed by his company for the changeover of a large textile mill from steam to electric power. Mr. Wright, electrical contractor on the job, said the order was $1500 to $1800*

## REWIRING BRANCH CIRCUITS

A Cleveland electrical contractor recently rewired a portion of the commercial offices of the Cleveland Electric Illuminating Co., using the new rubber covered small diameter building wire. All work was confined to the branch circuits, from the distribution panel to the outlet. Of the six floors on which work was done, three were completely rewired and only part of the circuits on the other floors were changed.

The work consisted of disconnecting the existing No. 14 two-wire circuits from the panels, switches, receptacles and fixtures; pulling out the present wires; pulling in new single phase

Connect with Burndy
in tight Spots
When you come up against tight spots in making connections there is no use beefing . . . the job must be done. Why not make the job easier by selecting Burndy Connectors. The type QPR shown here is only one of the many Burndy Connectors designed to reduce inconvenience where connectors are difficult to install.
BURNDY
BURNDY
Guttertap
SEE YOUR WHOLESALER FOR DETAILS ON THIS ITEM

## Estimating

[FROM PAGE 78]

three-wire circuits of No. 10 stranded Laytex small diameter wires and reconnecting the outlets and panelboard circuits. All branch circuits were in ½-inch conduits, with a few ¾-inch conduits for home runs, all concealed in the plaster walls and ceiling. All work was done in the daytime during office hours, when light requirements were low. The contractor experienced no trouble in pulling out the old wires or in fishing in the new ones.

The job record kept by the contractor contained the following data:

### WORK DONE

A part of the work included disconnecting and reconnecting the following list of outlets:

299—Ceiling outlets (fixtures)
241—Switch outlets
250—Receptacle outlets

790—Total number of outlets rewired

The rest of the work included pulling out the existing wires and installing 29,490 feet of No. 10 stranded Laytex small diameter wire, with an average length of 37-feet of wire per outlet.

### LABOR BREAKDOWN

PER OUTLET—includes disconnecting original circuit from panel and outlet, pulling out old wire, fishing in new wire and reconnecting outlet and panel switch.

| | |
|---|---|
| Total time | 658.34 m. h. |
| Average time per outlet | 0.845 m. h. |
| or | 50 minutes |

PER FOOT OF WIRE—includes the same work as above except that it is based on the time per foot of wire installed.

| | |
|---|---|
| Total time | 658.34 m. h. |
| Average time per ft. of wire | 0.023 m. h. |
| or | 1.38 minutes |

*Data from Harrington Electric Co., Cleveland, Ohio.*

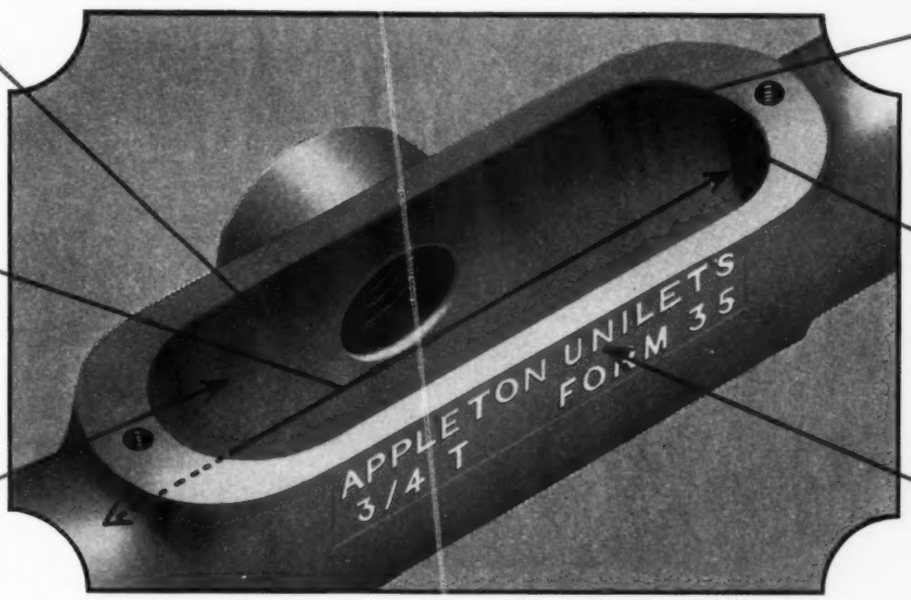
***STANDS PAT**—When Edward T. Phillips, electrical contractor of New Orleans gives a discount on equipment sales, he sticks to his guns. No amount of complaining will induce him to lower it. According to Mr. Phillips, when a customer gets his just discount there is no reason to discriminate by lowering it.*

# 6 Sound Reasons for APPLETON LEADERSHIP

SMOOTH, STURDY, CAST MALLEABLE IRON— NO HOLES, BLEMISHES, GATING MARKS

PERFECT HUB ALIGNMENT — EVERY BODY TRUE IN SHAPE

ROOMY— EASY TO WIRE




CADMIUM PLATED FOR LIFETIME RESISTANCE TO RUST AND CORROSION

WATERPROOF, CORROSION-PROOF JOINTS— SMOOTH AMPLE WIREWAY

EVERY APPLETON UNILET CARRIES THE APPLETON TRADE MARK

## Definite Superiority in Every Type — A Type for Every Need

Most—but not all—of the reasons for Appleton leadership are *built in!* Skillful design; rugged, flawless construction; perfect alignment; tight, smooth joints, are things you can see. They make for fast, sure work on every fitting job, and for lifetime satisfaction and safety.

Not built in, but fully as important, are the quick service you get on every order for Appleton Unilets, and the assurance that in the vast Appleton line is everything you need for *every* installation. Those Appleton advantages, too, contribute to your profit by saving your valuable time and that of your men!

Your wholesaler will gladly tell you how you can profit by standardizing on Appleton products for every job!

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# APPLETON

**Conduit Fittings • Outlet & Switch Boxes • Explosion-Proof Fittings • Reelites •**

# In the News

## HUGHES RECEIVES McGRAW AWARD

George A. Hughes, chairman of the Edison General Electric Appliance Company of Chicago, received the James H. McGraw Award Manufacturers Medal at

*MEDALIST George A. Hughes, who received the James H. McGraw Award for manufacturers.*

a special luncheon meeting at the convention of the National Electrical Manufacturers Association in New York, October 30. The presentation was made by H. P. Liversidge, president, Philadelphia Electric Co., in behalf of the Committee of Awards. The citation read—

"George. A. Hughes, chairman of the Edison General Electric Appliance Company of Chicago, began his career in the electrical industry operating small power systems in North Dakota and Montana. It was essentially a service to the home and he became deeply interested in the possibilities of electric cooking. He moved to Chicago, set up a shop and in 1910 produced the first commercially practical electric range. He straightway became the champion of a broader domestic use of electricity, to be made practicable by reduced rates for electricity used for cooking, this in turn to be justified by the larger load. He understood the difficult task of interpreting this philosophy and promoting its adoption by a power industry dominated by technical men, who were conscientiously guiding their systems, at that time, through the hazards of rapid engineering development, unceasing expansion and a general movement toward lowering the costs of electric lighting to the public.

So Mr. Hughes became not only a successful manufacturer but a promoter and propagandist, whose objective was not only to sell his confidence in electric cooking to the power companies, but to build public confidence in the power companies themselves. To this end, he diligently pioneered the development of electric cooking through the improvement of range design, on which he worked in hearty cooperation with other manufacturers. His vision of a broader service to the American home he carried about the country for a long period of years, preaching the gospel of electric service, expounding the right of the power company to merchandise appliances and defending them against political misunderstanding and persecution.

And so his dream became a realistic accomplishment. The interest and support of the power company men for this idea and the acceptance of the public for electric cooking increased steadily. It became not only a major service to the home but exerted wide influence on the general domestic use of electricity. In a word, the electric range was the springboard for the rise of promotional rates that have now become almost universal and have meant so much for the improvement of the American standard of living. And by his continuous devotion to his purpose, his undiscouraged persistence despite all opposition, his high ideals and business principles, his ready helpfulness in every emergency, Mr. Hughes has endeared himself to all electrical men, not only as the "Father of the Electric Range" but as a builder of electric markets, a leader in our progress, in which all branches of our industry have benefited.

In recognition of this long and arduous service to the electrical industry and his outstanding contribution to electrical manufacturing, the judges, on this 30th anniversary of the advent of the electric range, have awarded to Mr. Hughes the Manufacturers Medal and Purse for 1940 given under The James H. McGraw Award."

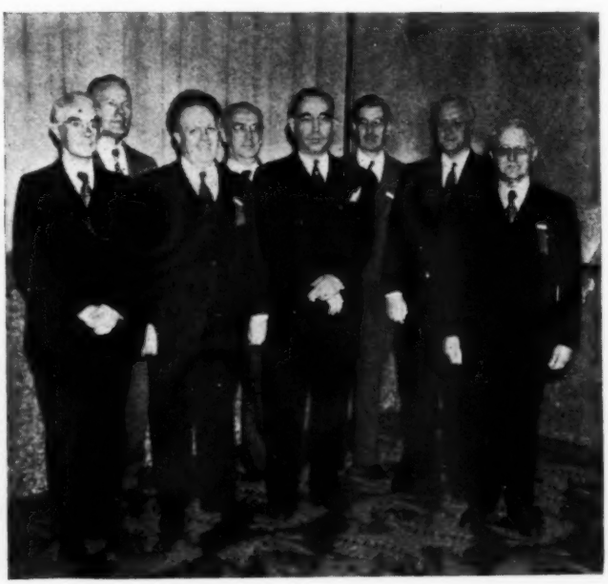
The judges who selected Mr. Hughes for the award were—H. B. Crouse, president, Crouse-Hinds Co., Syracuse, N. Y.; L. F. Adams, ass't vice-president, General Electric Co., Schenectady, N. Y.; Clarence L. Collens, president, The Reliance Electric & Engineering Co., Cleveland, Ohio; and George C. Thomas, Jr., vice-president, The Thomas & Betts Co., Elizabeth, N. J.

## EASTERN I.A.E.I. WANTS FLUORESCENT RULES

The eastern section of the International Association of Electrical Inspectors held its sixteenth annual convention at the Hotel New Yorker, New York City on Oct. 7 to 10 inclusive.

Armed with copies of the newly published 1940 code and a convention slogan "Let the Code Decide," almost 500 delegates devoted the greater part of the four day session to a comprehensive discussion of the articles and changes in the new code.

Deep concern was evidenced over the lack of code rulings on the construction and installation of fluorescent lighting units and the convention went on record, through a unanimous motion, approving the appointment of a committee "to study fluorescent lighting and prepare a set of rules governing the construction and installation of fluorescent lighting fixtures."



**NEW EXECUTIVES** *of the Eastern Section I.A.E.I., elected at the convention in New York City are (left to right) Ralph B. Ward, representative to the Executive Council; W. J. Canada, member of Executive Committee; James D. Lynett, president; J. S. Zebley, alternate to Electrical Committee; T. V. Ward, first vice-president; W. J. Mahan, member of Electrical Committee; F. N. M. Squires, secretary and A. W. Hopkins, treasurer. Executive Committee members C. A. Berlepsch, R. B. Shepard and second vice-president Ralph Eaton are not present.*

*A Complete New Line of*

# FLUORESCENT LAMP BALLASTS

...by CHICAGO TRANSFORMER CORPORATION

## *New... Reliable... Tested...Approved*

- *Here are new ballasts with a keynote of reliability...A complete line designed and built to maintain high operating performance and low losses with an absolute minimum of hum.*
- *Listed by the Underwriters' Laboratories—And guaranteed to comply with the specifications established by lamp manufacturers.*
- *Special emphasis has been placed on case designs. Cases are of heavy drawn and formed-steel construction with standard mounting hole and small cross-sectional dimensions. All ballasts are finished in chip-proof enamel.*
- *Offered in 15, 20, 30 and 40 watt sizes for operation on 118, 208 or 236 volts, and for single and two-lamp installations, 50 or 60 cycles—and in the high power-factor types.*
- *Mail the attached coupon, today, for full details on this new line of safe, reliable, business-building fluorescent lamp ballasts.*

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## In the News

[FROM PAGE 82]

Objection was also voiced against the minimum requirement of No. 22 USS gauge metal for recessed fixture enclosures mentioned in section 94102b of the new code. The delegates passed a resolution suggesting that future codes require a minimum of No. 20 gauge metal with the thickness and weight increasing in proportion to the size of the enclosure.

An interim amendment to the new code was proposed by the Committee on Interior Illumination of the National Sign Association. This committee stated that the new code limitations on inside wiring in article 600 were too severe for commercial lighting on transformers of 60 milliamperes or less and proposed retention of the 1937 limits for schools and residences. This proposal was referred to the Chairman of the Article Committee for consideration.

Instructive talks were given by E. E. DeMarsh, Burndy Engineering Co., on "Recent Research on Wire Connectors"; Harry Bussman, Bussman Mfg. Co., on "Effects of Time Lag in Relation to Protective Devices" and J. L. Waggoner, Westinghouse Electric & Mfg. Co., who discussed "Overcurrent Protection." Explanations of The New Types of Wires and their Insulations were made by M. M. Brandon, Underwriters Laboratories, Inc., and Howard Weber, U. S. Rubber Co. Mr. Weber also conducted a quiz program on the applications of the new small diameter wires.

Fluorescent equipment, lamps, controls and the inspectors problems in this field were discussed by E. W. Beggs, Westinghouse Electric & Mfg. Co.; F. Neumer, Underwriters Laboratories, Inc. and J. D. Lynett, Chief Electrical Inspector, City of New York.

Between business sessions, the delegates had the opportunity to view the latest development in electrical equipment on display by some 36 manufacturers in the product exhibit. The entertainment program included visits to a radio broadcast, the New York World's Fair, the Underwriters Laboratories, Inc., a luncheon with the Electrical and Gas Association of New York and the Annual Dinner-Dance and Banquet at the Hotel Astor.

At the final business session the following officers were elected: president, James D. Lynett, New York; 1st vice-president, T. V. Ward, Washington; 2nd vice-president, Ralph Eaton, Providence; Treasurer, A. W. Hopkins, Springfield and secretary, F. N. M. Squires, New York. Executive Committee members are C. A. Berlepsch, W. J. Canada and R. B. Shepard. F. N. M. Squires and R. B. Ward are representatives to the Executive Council. Representatives to the Electrical Committee are W. J. Mahan and F. N. M. Squires, members, R. B. Ward and J. S. Zebley, alternates.

*SIGNING UP—L. Pete Dendel of Lansing, gets his badge and tickets at the Kansas City meeting of the IAEI.*

Washington, D. C. was chosen as the 1941 convention city and plans call for a joint meeting with the Southern Section at that time.

### FLUORESCENT SALES SCHOOL

A sales school on fluorescent lighting will be held at the Chicago Lighting Institute November 11 and 13.

Identical sessions will be conducted each day and the sessions will be similar in scope to the previous school, held in February, which drew an attendance of 1,200 persons from all parts of the Middlewest.

Electrical contractors, wholesaler's representatives, manufacturers, utility salesmen and others concerned with the sale of fluorescent lighting equipment will attend.

### NEW JERSEY LEAGUE CONVENES

The New Jersey Council of Electrical Leagues held its eighth annual convention at the Hotel Traymore, Atlantic City on October 5. More than 130 delegates, representing electrical leagues throughout the state, met to discuss problems of the electrical industry in the state of New Jersey.

At the business session three important resolutions were adopted. The first favored the appointment of a committee to "seek a general reduction and more equitable rate for electrical inspections." The second called for the appointment of a committee of five contractors from various sections of the state to "seek the best available means to protect the general public and to properly license all individuals and companies conducting an electrical contracting enterprise in the state of New Jersey." The third authorized the creation of a committee of jobber, contractor and manufacturer representatives to "eradicate existing evils and promote honest, sincere and

"I don't want any outlets—Just drill a hole in the wall so I can hear the Schmaltzes' fight!"

# *TO ASSURE*
# NATIONAL DEFENSE PRODUCTION

**FLUORESCENT LIGHTING**
*by Westinghouse*

With National Defense uppermost in the minds of Management, American Industry and Commerce now turn to the *means of obtaining* high speed production.

A "*Must*" among production facilities—in both plants and offices—is *sound, adequate lighting*. Westinghouse suggests to Contractors and Engineers that Fluorescent Lighting aptly fits National Defense work requirements because the higher illumination levels so essential to high speed and accuracy are now made economically possible.

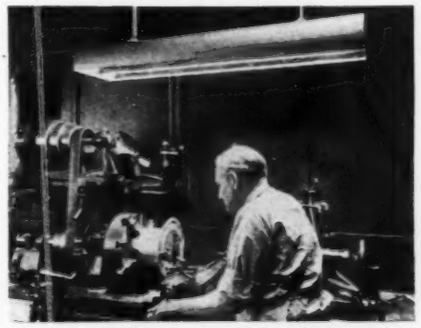
Fluorescent Lighting helps step up production, makes possible work with fewer errors, improves inspection operations, increases precision workmanship, and reduces rejects. Furthermore, it gives adequate visibility for *every* shift, and assures greater accuracy in delicate, light-demanding tasks.

Fluorescent Lighting by Westinghouse blankets every industrial and commercial requirement. Features include rugged lamp holders, dependable starters, a variety of porcelain enameled and Alzak Aluminum reflectors and several types of mountings.

There are 117 Westinghouse Electric Supply Company offices or Independent Westinghouse Lighting Distributors to make it easy for you to obtain Fluorescent Lighting anywhere in the United States. Ask your Westinghouse Lighting Distributor today for full information. Westinghouse also makes a complete line of Mazda Lighting equipment, including Protective Floodlighting. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

**Tune in "Musical Americana," N. B. C. Red Network, Coast-to-Coast, every Thursday evening.**

In inspection operations Fluorescent Lighting reduces rejects.



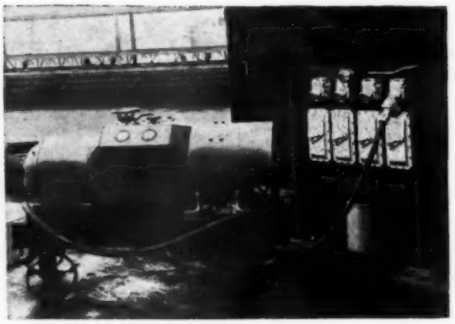
Adequate illumination for the finest precision operations.

Fluorescent Lighting brings daylight in this airplane engine manufacturing plant.

**Westinghouse**
**FLUORESCENT LIGHTING**

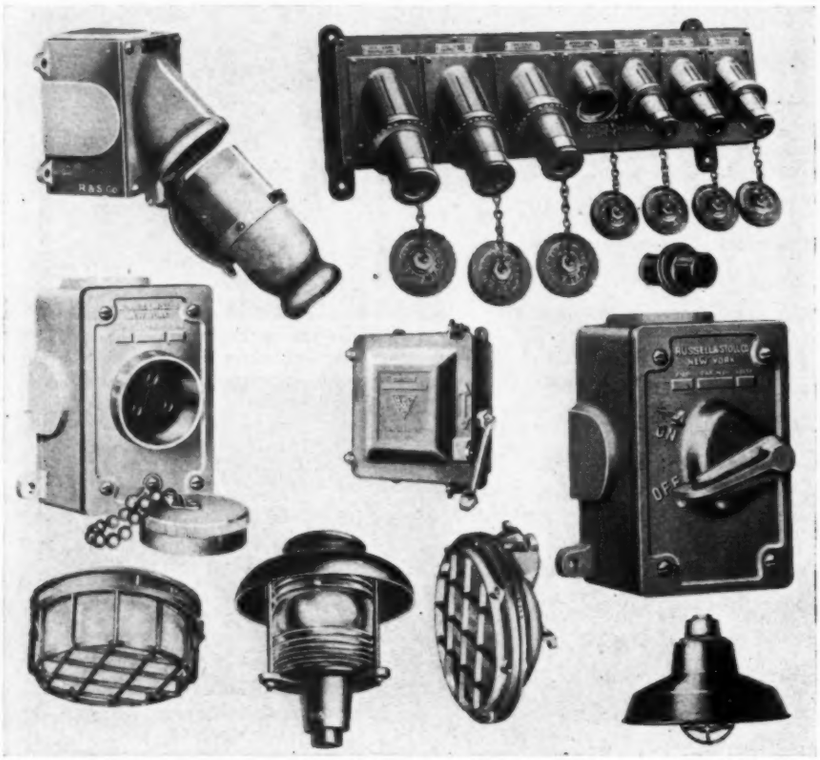
For

# SPECIAL OUTDOOR SERVICES



**—turn to pages 60 to 67 of the R & S Catalog**

**These are devoted to water and dust-tight receptacles; circuit breaker and fuse combinations.**



**Today's call for production means both indoor and outdoor power supply, for protection of property, for control of circuits and machines.**

**For exposed, hazardous or underwater conditions, R & S is your dependable source of supply.**

**The R & S new 256-page Catalog not only illustrates the line, but also affords you a textbook on the many unusual problems you will be faced with in the coming months. The coupon is for your convenience in requesting your copy.**

## RUSSELL & STOLL COMPANY

*(And Subsidiary, Feedrail Corporation)*

**150 Park Place, New York**

RUSSELL & STOLL COMPANY
150 PARK PLACE,
NEW YORK, N. Y.

Send copy of new R & S Catalog to
Mr. .....
Title .....
Company .....
Address .....


## In the News

[FROM PAGE 84]

fair trade relations between these groups."

Instructive addresses were delivered by Harold Abel, Crescent Insulated Wire and Cable Co., on "Small Diameter Wire"; Ralph Morison, General Electric Co., Lamp Division, on "Fluorescent Lighting" and C. H. Harman, Middle Department Rating Association, on "Inspection Fees for Electrical Installations."

After adjournment of the business session, the delegates and their guests enjoyed the annual banquet and dance.

***PAPER HATS** marked the members of the train committee, when 150 electrical inspectors entrained for the Western Section IAEI meeting at Kansas City. They had to answer all reasonable questions or be dropped at the next stop. Here are E. M. Nelson, Booster Chairman Sam Todd, E. H. Huish and Charles Coutts.*

### ESTIMATING CLASSES

The Minnesota Electrical Council, of Minneapolis, is sponsoring an estimating school at which 30 electrical contractors and their employees are registered. The ten weekly sessions started September 3.

A nominal registration fee is required for the ten week course. Present classes are for the Twin City members of the Council. Plans are being considered for extending the school to outlying Council members.

### ELECTRICAL LEAGUE LIGHTING SCHOOL

The Maintenance Division of the Essex Electrical League, Newark, N. J., launched its third annual instruction course Oct. 2. This year the course will cover Industrial Lighting in a series of five lecture-demonstrations under the direction of Arthur W. Martinson, Lighting Specialist of the General Electric Co. in New Jersey.

At the first session, Ray C. Smith, Illuminating Engineer, Western Electric Co., Kearny, N. J., discussed "Plant Lighting Experience." Speakers and subject matter for the rest of the course will include Karl Staley, Illuminating Engineer,

Automatic Electric intercommunicating systems are designed for private service. They are not intended to be connected with the public telephone system.

Because it's such an easy way to make "plus" profits, more and more electrical contractors are taking steps to sell Automatic Electric private telephone systems to their customers.

If you are not yet offering these popular intercommunicating systems begin at once and start getting your share of this paying business.

Your local electrical wholesaler will be pleased to supply you with full information, literature and prices on the complete line. Talk to him today.

# AUTOMATIC ELECTRIC

## PRIVATE INTERIOR TELEPHONE SYSTEMS

**Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois**

Sales and Service Offices in Principal Cities • In Canada: Canadian Telephones & Supplies, Limited, Toronto

# THIS SOLDER DOES *BETTER WORK* WITH LESS GRIEF!

Here's a contractor who is giving his men a real piece of sound advice. Kester Rosin-Core Solder can't be beat for getting perfect results on all kinds of electrical installations.

The special rosin-flux in the core of the solder itself eliminates an important cause of corrosion and reduces fire hazard.

It pays real dividends in better and faster workmanship to specify Kester Cored Solders on all types of metal work. These solders are made of highest quality, virgin metals and are available in many combinations of alloys, fluxes, strand-sizes and core-sizes.

Order from your jobber.

**KESTER SOLDER COMPANY**

**4208 Wrightwood Avenue, Chicago, Illinois**

*Eastern Plant:* Newark, N. J.

*Canadian Plant:* Brantford, Ont.

**KESTER**

**ROSIN-CORE SOLDER**

*STANDARD FOR ELECTRICAL WORK*


## In the News

[FROM PAGE 86]

G. E. Lamp Dept., who will talk on the "Fundamentals of Illumination and the Science of Seeing"; R. W. Stanley, The Holophane Co., who will outline "Methods of Light Control"; R. E. Clisdell, Lecturer at Columbia University, will discuss "Protective Lighting" and Ollie H. Rees, Engineer, G.E. Co., will give the "Application of Drying Lamps in Industry."

*SHOP SPECIALISTS — Homer E. Newell (left), president, and Max Hamann, works manager, of Electrical Engineering and Service, Inc., of Westfield, Mass., have built up an enviable business after two and one half years together. Adequate equipment to handle any size job, high quality workmanship, service and advertising are the basis of their success.*

## COMING MEETINGS

**Chicago Lighting Institute**—Second Fluorescent Lighting Sales Conference, Institute headquarters, 20 North Wacker Drive, Chicago, November 11-13.

**Adequate Wiring Conference**—Sponsored by the National Adequate Wiring Bureau and the International Association of Electrical Leagues, Palmer House, Chicago, November 12.

**International Association of Electrical Leagues** — Annual Conference, Palmer House, Chicago, Ill., Nov. 13-14.

**North Dakota Electrical Contractors' Association**—Annual Meeting, Fargo, N. D., Nov. 15-17.

**American Institute of Electrical Engineers**—Winter Convention, Philadelphia, Pa., January 27-31.

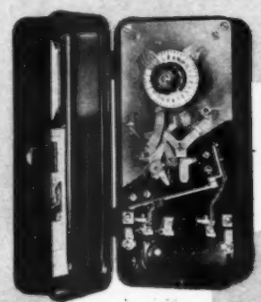
## ADEQUATE WIRING REPORTS

The following are reports of the activities of the Adequate Wiring Bureau in some of its field offices:

*New Orleans, La.*—The first adequate wiring certificate has been issued to a local operative builder for three homes. Eight additional homes will be ready for certification within a few weeks.

# IS THIS FEATURE ON THE TIME-SWITCH YOU NOW BUY?

***the opportunity of choosing from* A COMPLETE LINE...**



Form KA for applications where no variations are required from a regular daily sequence.

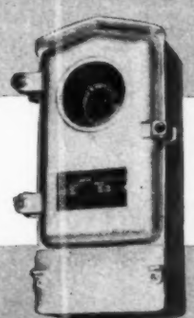
Form KAZ. The astronomic dial changes automatically "on" and "off" operations in accordance with suntime.

Form VSW provides an automatic carry-over, assuring continuous operation during current interruptions.

Form VSWZ operates the same as Form VSW with the added advantage of an automatic astronomic dial.

Form VW is an electrically wound time-switch for A.C. operation, available in a wide variety of combinations.

Form KAY is a two-circuit time-switch in which the "on" and "off" circuits of each are independent.



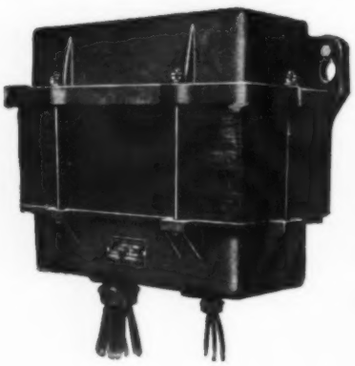
Form KAHO. A completely weather-proof time-switch available in all ratings.

Form KAHD duplex. Two separate switch units are operated by the same timing mechanism.

**....FOR EVERY PRACTICAL APPLICATION**

**SANGAMO ELECTRIC COMPANY** SPRINGFIELD ILLINOIS

# FOUR POINT ECONOMY—



Above: Type CFT, three-phase, outdoor-type, air-cooled, general-purpose transformer.

Below: Type CF, Single-phase, outdoor-type, air-cooled, general - purpose transformer.

**1** LOW INITIAL INVESTMENT

**2** EASY TO INSTALL

**3** MINIMUM MAINTENANCE

**4** EFFICIENT IN OPERATION

**Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.**

* Units rated 15 Kva. and larger for indoor service only.

**Type "CF" Applications**

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power system.
4. Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

**AMERICAN TRANSFORMER COMPANY**

**178 Emmet St. Newark, N. J.**

**PRODUCTS**

American Transformer Co. manufactures transformers for every industrial, electronic and laboratory application in sizes up to 10,000 Kva and for potentials up to 132 Kv. Other products: voltage regulators, test sets, rectifiers.

**AMERTRAN TRANSFORMERS**

*Manufactured Since 1901 at Newark, N. J.*


## In the News

[FROM PAGE 88]

**Akron, Ohio**—A three room house costing $1000 has recently been certified for adequate wiring. The house has five ceiling, three wall, nine switch and ten convenience outlets. The distribution consists of one 20-ampere appliance circuit, two 15-ampere lighting circuits and a range circuit.

**Hartford, Conn.**—Eight adequately wired model homes were inspected by 75,000 interested parties during a two week period ending Oct. 12. All but one of the homes, ranging in price from $4,300 to $9,000, were sold. Also six others completed by builders in their developments.

## —WITH THE— Manufacturers

### Graybar Changes

Douglas Wallace, formerly Peninsular district manager at Jacksonville, has become assistant general sales manager of the Graybar Electric Company. His headquarters are at 420 Lexington Avenue, New York.

L. G. Field, manager at Miami since 1937, has been transferred to Jacksonville to take the place of Mr. Wallace.

•

### Roebling Appointments

The John A. Roebling's Sons Company of Trenton, N. J. announces the appointment of Roger H. Clapp, formerly Philadelphia branch manager, as assistant general manager of sales, with headquarters in Trenton.

Earl N. Graf, former manager of the Pittsburgh branch has been made assistant manager of sales, Wire Rope Division, with headquarters at Trenton.

•

**Westinghouse Electric & Manufacturing Co.** has appointed Jesse H. Lide as assistant manager of the merchandise advertising and sales promotion department of the Westinghouse merchandising division. For the last six years Mr. Lide has been sales development manager of the merchandising division's middle atlantic district, with headquarters in Philadelphia. This is a newly created position with headquarters in Mansfield, Ohio.

He is being succeeded in Philadelphia by S. F. Myers, former sales development manager of the air conditioning and commercial refrigeration department in East Springfield, Mass.

INJECT

# SECURITY

INTO

WIRING JOBS!

You're the doctor when it comes to choosing tapes! But if you'll take a tip from thousands of successful contractors, *you'll pick U. S. Security Tapes.* Be sure of safer, more permanent jobs . . . done quicker and easier. Choose and use U. S. Security Tapes for all your wiring work.

THE SEAL OF SECURITY

**UNITED STATES RUBBER COMPANY**

**ROCKEFELLER CENTER • NEW YORK CITY**

# 2 *New* McGILL Guards

## . . . *with NEW utility features*

No. 7060

**No. 7060 — This McGILL Guard is an addition to the popular No. 7000 line. It is made in a smaller size to accommodate lamps from 25 to 60 watts. The cage, of extra-heavy steel wire, has all joints electrically welded. Handle is of highest quality black molded rubber. Four styles comprise this series and are available with or without reflectors, closed cages, lever or keyless sockets. No cam arrangement as in No. 7100.**

No. 7100

**No. 7100 — The fifteen McGILL Guards in this series differ from the No. 7000 line in that a wire collar supplants the flat band at the base of the cage. A cam arrangement (above) holds the cage to the hand-fitting, black, molded rubber handle instead of screws, making for easier and faster lamp changing without the use of any tools. Available with or without reflectors, closed cages, lever or keyless sockets.**

**Write for full Particulars**

ELECTRICAL DIVISION

**McGILL MFG. COMPANY**

**Box 670 VALPARAISO, IND.**

McGILL


## *In the News*

[FROM PAGE 90]

### New Curtis Officers

Curtis Lighting, Inc. of Chicago announces the appointment of three vice-presidents and a secretary-treasurer.

M. C. Wilt becomes vice-president and general manager; G. T. Morrow, vice-president in charge of sales; H. J. Dillon, vice-president in charge of production and L. N. West, secretary-treasurer.

•

**Habirshaw Cable and Wire Division** of the Phelps Dodge Copper Products Corporation of New York, announces the appointment of Kenneth S. Wyatt, cable engineer, to its staff.

•

**Cutler-Hammer, Inc.** of Milwaukee has appointed R. L. Hibbard to the merchandising sales staff of the Detroit office. He was formerly in the New York office.

•

**Airtemp Division** of Chrysler Corporation has appointed Earl Marr as General Sales manager.

•

**Coffing Hoist Company** has moved into its new factory and office building in Danville, Illinois.

•

**The Standard Transformer Company** of Warren, Ohio, announces that H. G. Johnson, 1124 Park Square Building, Boston, Mass., will become its New England sales representative on November 23, 1940.

•

**H. B. Sherman Mfg. Co.,** Battle Creek, Mich. has appointed L. M. Stinchcomb as sales manager of the electrical division.

•

**Federal Electric Company** of Chicago, has announced the appointment of Frederick W. Fulle as manager of its New York office. Mr. Fulle was formerly vice-president in charge of sales of Claude Neon Lights, Inc., New York.

•

**The DoAll Company** has opened a new factory at 1201–1225 Thacker Street, Des Plaines, Ill. They will produce narrow precision band saws for metal cutting.


# SAY SHUR-LAG TO END FUSE TROUBLES

AND ASK FOR OUR **BULLETIN 400** TO SEE WHY

*The*

**CHASE-SHAWMUT COMPANY**

**NEWBURYPORT, MASSACHUSETTS**

# EASY TO SELL—"Saves Call Backs"—EASY TO INSTALL

## Ask Us Another

**What contact material is used in small G-E manual and magnetic starters?**

Fine silver, which is 99.9% pure silver, is used. Oxides form slowly on this material; if oxides form, they are reduced to pure silver and returned to face of contact by heat due to current flow. This means maximum tip life *without filing.*

**What advantages has a toggle-operated manual switch over one that is push-button operated?**

The toggle operation indicates to operator that he is using a manual control which does not protect him against restarting in case of power failure.

**Are G-E manual starters available for dusty, wet, or hazardous locations?**

Yes. Dust-tight and water-tight enclosures, as well as Class I, Group D listed by the Underwriters are available for both these starters.

**JONES ELECTRIC CO.**
12494 MADISON ST.
(ANSHINGTON N.Y.)

Repairing defective
motor starter
6 hours labor .30
Repair parts .83
Telephone charge .25
Truck tied up
Overhead [illegible]
Service [illegible] .35
No Charge
Hw

# G-E MANUAL STARTERS

*These features eliminate "call backs"*

**Every time you "call back" after completing a job you're eating up profits. A workman's time is lost. And even more important than wasted time, you may be losing customer good will and confidence.**

**One good way to stop such waste is to install only motor-control devices you can depend on. G-E controls like those shown above and described on the next page will *save you time and make your jobs more profitable.***

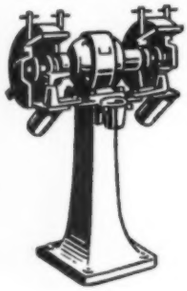
...m
...is of
...en you
...proximity
...the point of
...eatest economy

# *Easy to See Why*

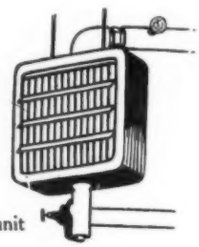
# YOU'LL SAVE COSTLY "CALL-BACKS" WITH G-E MANUAL STARTERS

## *Where to Use* G-E MANUAL STARTERS

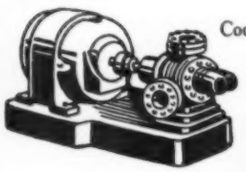
**Rule: A manual starter is suitable any place where a small motor can be hand controlled from a single point nearby.**



Small-hp machines or grinders

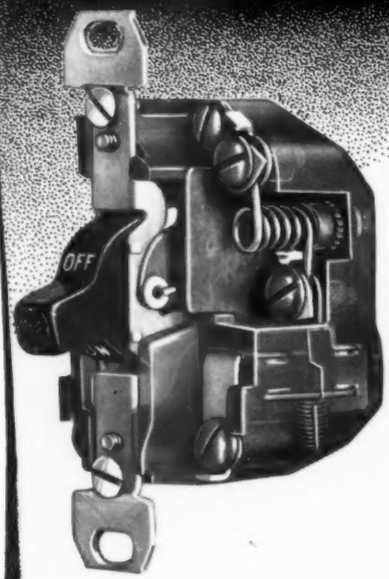


Ventilating fans or unit heaters



Coolant pumps

Job presses, bindery equipment, etc.




### CR1061 for Motors to ¾ Hp

Switch element, removed from case, suitable for fitting into standard deep switch box.

Overload heater, selected to suit motor to be protected, easily installed on switch.

Solder-film-type overload device protects motor against serious overheating.

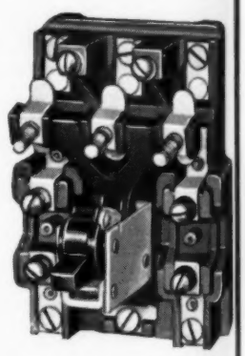
Trip-free mechanism cannot be held closed during excessive overload.

Simple quick-make, quick-break, snap-action toggle mechanism assures maximum contact life.

Arcing chamber encloses long-lived, double-break, fine-silver contacts—minimizes arcing and provides high interrupting capacity.

Large terminal screws facilitate making good connection.

### CR1062 for Motors to 7½ Hp



This switch element removed from its enclosure is typical of manual starters rated 7½ hp at 440 volts.

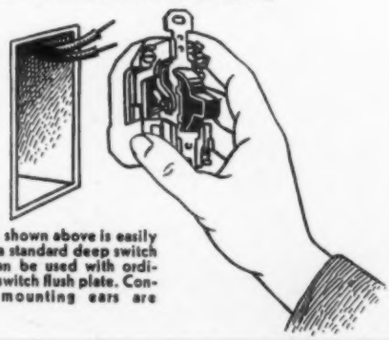
Convenient terminals at top and bottom for line and load connection.

Fine-silver contacts, separated by arc barriers, provide high interrupting capacity and long life.

Operated by sturdy handle of molded Textolite.

Thermal overload device protects motor against serious overheating. Replaceable heater is selected to suit motor.

**INSTALLATION NOTE**



The CR1061 shown above is easily installed in a standard deep switch box, and can be used with ordinary toggle-switch flush plate. Conventional mounting ears are provided.

**Fortify yourself against "call-backs" due to starter or motor trouble by using G-E starters. They are so widely accepted that they're sure to please your customers. And they're easy to install, too—will save you time on the job.**

**There is a G-E distributor near you with a complete stock of these manual starters—and the entire line of G-E control. General Electric, Schenectady, N. Y.**

**GENERAL ELECTRIC**

676-6

# Industrial Electrification and MAINTENANCE

## POWER FACTOR

A LONG with the discovery of new applications for electricity comes the development of more efficient means of using this energy, both from the standpoint of performance and economics. Power factor is one of the most important items to be considered in this drive for electrical economy and perfection. Power factor is one of the most widely used terms in the vocabulary of the electrical man whether he be an engineer, contractor or maintenance man. And the importance of power factor in plant operation is being recognized more each day. So, it is of vital interest to the maintenance man, for it is he who must report on the power factor condition of the plant, why it is that way and, if unsatisfactory, how to remedy it.

What is Power Factor? One can't see it but, like electrical current, one knows that it exists. It can be accurately measured by instruments in several different ways. It can be calculated by juggling around watts, volts, amperes, resistance, reactance and a few other electrical quantities. But at the bottom of it all, what is being measured or calculated? What is its significance? What effect does this seemingly innocent expression have on the operation of an electrical system? How can it be determined and measured? Answers to these and other relative questions will be found in the accompanying discussion on the causes and effects of power factor. Power factor correction will be reviewed next month.

Previous articles covered—

1. Simplifying Electrical Maintenance
2. Preventive Maintenance of Distribution Systems
3. Preventive Maintenance of Electical Equipment
4. Reducing Power Costs
5. Maintaining Good Power Factor (this issue)

Future articles will discuss—

6. Power Factor Correction
7. Meeting Severe Service Conditions
8. Safety Protection for Electrical Operations
9. Increasing Flexibility of Electrical Service
10. Providing Adequate Capacity for Increased Demand
11. Extending Automatic Control
12. Electrifying Operations to Reduce Unit Costs
13. Methods for Handling Changeovers and Live Circuits

# MAINTAINING GOOD POWER FACTOR

## PART I—Causes and Effects of Low Power Factor

THE plant may run at part or full capacity. Expansion may be contemplated or has just been made. But the electrical maintenance man is ever confronted with the problem of maintaining good power factor.

Some applications and operations causing low power factor in the plant may be obvious and easily handled. Others are beyond the control of the maintenance man. However, tests and a study of conditions in the entire plant, as well as departments or processes and individual machines, will enable him to determine where correction can be made.

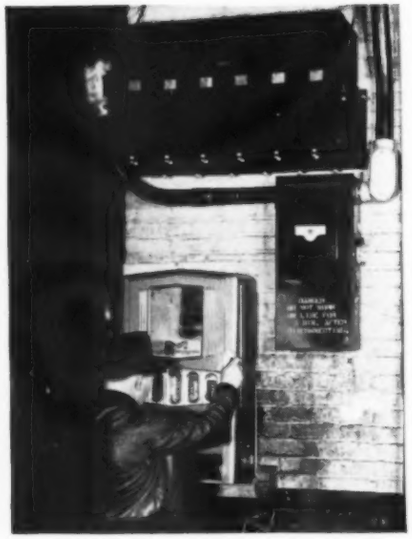
The complete discussion provides (1) a program for the study of the subject and (2) ideas for increasing power factor and maintaining it in its improved state. This immediate discussion (Part I) includes a few fundamentals, covers principally the effects of low power factor and what causes it, and also how it can be measured.

### 1. What is Power Factor?

Power factor can be explained by a very simple example. Consider that to obtain a finished wood block of 16 cu. in. requires that it be cut from a rough piece of 20 cu. in. If the amount of material in the finished block is divided by the amount of material in the rough piece, you have a ratio of useful material to total material, or, using the numerical values, 16/20 or 80 per cent. Then if the useful material represents useful electric power and the total material represents total power required, you have a ratio of useful power to total power. This ratio is known as power factor. The wood scrap resulting from the finishing of the block represents useless (wattless or reactive) power.

Useful (active or real) power is measured by a wattmeter and is expressed usually in kilowatts (kw.). Reactive power is measured by a reactive kilovolt-ampere meter, and is expressed in reactive kilovolt-amperes (kvar.). Total or apparent power is the product of volts times amperes, which values are measured by respective instruments, and is expressed usually in kilovolt-amperes (kva.). Power factor (pf.) is a ratio of active power to ap-

***LIGHT LOADS** resulted in power factor varying from 31 to 58 per cent on elevator m.g. sets in Union Central Life Insurance Building, Cincinnati. Capacitors, totalling 200 kva, mounted on starting panels, increased voltage at m.g. sets and corrected plant power factor to 97 per cent.*



***INCREASED CONDUCTOR SIZES** appeared necessary when power factor was 67 per cent for the plant of Ferro Machine and Foundry Co., Cleveland. A total of 600 kva. dust-tight capacitors was connected in the system. Power factor was increased to an average of 97 per cent. New feeder capacity is adequate. Capacitors paid for themselves in 16 months by reducing total power costs 8 per cent (Westinghouse photo).*

parent power and is expressed as a decimal or as a percentage. Thus pf = kw/kva = 16/20 = 0.8 = 80%.

On alternating-current systems, voltage and current are "in phase" with each other when they pass simultaneously through corresponding values in their cycles. For this condition power factor is said to be unity (1.0 or 100%). Power factor is less than unity when the voltage and current are "out of phase." If the current passes through its value in the cycle after the voltage has reached its corresponding value, the current is said to be "lagging," and a lagging power factor is produced. When the current "leads" the voltage, a "leading" power factor is produced.

An a.c. circuit having only ohmic resistance has unity power factor. This value is approximated when the load consists of equipment such as incandescent lamps, heaters and ovens. Induction apparatus, such as induction motors and transformers, has reactance and is responsible for lagging power factor. Electrical equipment, such as capacitors, which have the property of capacitance, or such as synchronous motors or synchronous condensers which operate with a leading current, produces a leading power factor. The leading current of the latter equipment counteracts lagging current and hence improves power factor.

For our immediate purpose, good power factor will be considered as 85 per cent or higher. This value has been selected principally because many power contracts contain a clause for maintaining a power factor of 85 per cent or better and include a penalty charge for low power factor.

## 2. Effects of Low Lagging Power Factor

Branch circuits, feeders, transformers and generators are limited in their ratings by current-carrying capacity. The power or kilowatt load which the equipment may safely carry is proportional to the power factor of the load. For example: the kw. load that can be carried at 80 per cent power factor is only 80 per cent of the kw. load that could be carried at 100 per cent or unity power factor.

Low power factor may not be serious, where the ampere load does not exceed the current-carrying capacity of the distribution system or the generating equipment. But it must be remembered that there is an additional load that must be carried, caused by the extra heating loss in wiring between the generator and power consuming equipment.

*Losses* ($I^2R$) caused by current heating the conductors are proportional to the square of the current and vary inversely as the square of the power factor. Thus higher losses are introduced when useful current plus reactive current flows through the equipment.

An increase in reactive current which flows back and forth in the circuit increases the amount of current in the line and, therefore, necessitates additional conductor capacity. Likewise, generators, transformers, switches and other equipment must have a greater capacity. Obviously, an increase in equipment capacity due to decreased power factor results in higher investments.

*Voltage drop* increases with decreasing power factor. Reactive current in transformers and lines introduces a voltage drop which subtracts directly from the applied voltage. (For the effect of low voltage applied to motors and lamps see the Maintenance Guide Chart in ELECTRICAL CONTRACTING, October 1940.)

*Voltage regulation* is affected by the loading of the equipment with lagging reactive current. If generators and exciters are not designed for low power factor operation, the voltage cannot be maintained under this condition.

Some specific effects of low lagging power factor are:

(a) Reduction of useful capacity in distribution systems and generators.

(b) Increase in investment of electrical equipment to supply the capacity needed for useful power and losses.

(c) Heating of conductors, switches, transformers and generators.

(d) Increase of losses in branch circuits, feeders and transformers.

(e) Increase of voltage drop in distribution systems.

(f) Reduction of voltage at terminals of production machines.

(g) Reduction of lumen output of lighting units due to the voltage drop.

(h) Impairment of voltage regulation.

(i) Reflection in productive output of plant.

(j) Increased power costs.

## 3. Causes of Low (Lagging) Power Factor

Practically all a.c. systems of power users have a lagging power factor, caused by the use of induction apparatus and devices. Such electrical equipment when connected in the circuit draws excitation or magnetizing current from the line continuously. This current lags and is termed "reactive," to differentiate from the "energy" or useful current for performing actual work.

Magnetizing current is practically constant regardless of the load on the equipment, and consequently the proportion of wattless to useful current increases as the load is reduced. Also, excitation current increases as voltage is increased above the nameplate rating, and as a result power factor decreases.

*Induction motors* are usually the largest load and account for most conditions causing low power factor in many plants. They convert electrical energy into mechanical energy and employ

***INDUCTION MOTOR** drive for an air compressor was replaced by a synchronous motor, 125 hp., 80 per cent leading power factor. Plant power factor averages 90 per cent and yearly power factor rebate averages $416, which, coupled with increased operating efficiency, results in an annual return of over 30 per cent on the original investment. Installation for City of Los Angeles at Hyperion Sewage Treatment plant, El Segundo, Calif. (Fairbanks, Morse and Co. photo).*

# MAINTENANCE GUIDE SHEET

## POWER FACTOR CORRECTION WITH CAPACITORS

### Table of Factors for Calculating Necessary Capacitor Kva to Improve Load to Desired Power Factor

DESIRED POWER-FACTOR IN PERCENTAGE

| ORIGINAL POWER-FACTOR IN PERCENTAGE | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 2.429 | 2.455 | 2.480 | 2.507 | 2.534 | 2.560 | 2.585 | 2.613 | 2.640 | 2.666 | 2.695 | 2.723 | 2.753 | 2.784 | 2.815 | 2.849 | 2.886 | 2.928 | 2.978 | 3.037 | 3.179 |
| 31 | 2.317 | 2.343 | 2.368 | 2.395 | 2.422 | 2.448 | 2.473 | 2.501 | 2.528 | 2.554 | 2.583 | 2.611 | 2.641 | 2.672 | 2.703 | 2.737 | 2.774 | 2.816 | 2.866 | 2.925 | 3.067 |
| 32 | 2.210 | 2.236 | 2.261 | 2.288 | 2.315 | 2.341 | 2.366 | 2.394 | 2.421 | 2.447 | 2.476 | 2.504 | 2.534 | 2.565 | 2.596 | 2.630 | 2.667 | 2.709 | 2.759 | 2.818 | 2.960 |
| 33 | 2.111 | 2.137 | 2.162 | 2.189 | 2.216 | 2.242 | 2.267 | 2.295 | 2.322 | 2.348 | 2.377 | 2.405 | 2.435 | 2.466 | 2.497 | 2.531 | 2.568 | 2.610 | 2.660 | 2.719 | 2.861 |
| 34 | 2.016 | 2.042 | 2.067 | 2.094 | 2.121 | 2.147 | 2.172 | 2.200 | 2.227 | 2.253 | 2.282 | 2.310 | 2.340 | 2.371 | 2.402 | 2.436 | 2.473 | 2.515 | 2.565 | 2.624 | 2.766 |
| 35 | 1.927 | 1.953 | 1.978 | 2.005 | 2.032 | 2.058 | 2.083 | 2.111 | 2.138 | 2.164 | 2.193 | 2.221 | 2.251 | 2.282 | 2.313 | 2.347 | 2.384 | 2.426 | 2.476 | 2.535 | 2.677 |
| 36 | 1.841 | 1.867 | 1.892 | 1.919 | 1.946 | 1.972 | 1.997 | 2.025 | 2.052 | 2.078 | 2.107 | 2.135 | 2.165 | 2.196 | 2.227 | 2.261 | 2.298 | 2.340 | 2.390 | 2.449 | 2.591 |
| 37 | 1.761 | 1.787 | 1.812 | 1.839 | 1.866 | 1.892 | 1.917 | 1.945 | 1.972 | 1.998 | 2.027 | 2.055 | 2.085 | 2.116 | 2.147 | 2.181 | 2.218 | 2.260 | 2.310 | 2.369 | 2.511 |
| 38 | 1.684 | 1.710 | 1.735 | 1.762 | 1.789 | 1.815 | 1.840 | 1.868 | 1.895 | 1.921 | 1.950 | 1.978 | 2.008 | 2.039 | 2.070 | 2.104 | 2.141 | 2.183 | 2.233 | 2.292 | 2.434 |
| 39 | 1.611 | 1.637 | 1.662 | 1.689 | 1.716 | 1.742 | 1.767 | 1.795 | 1.822 | 1.848 | 1.877 | 1.905 | 1.935 | 1.966 | 1.997 | 2.031 | 2.068 | 2.110 | 2.160 | 2.219 | 2.361 |
| 40 | 1.537 | 1.564 | 1.591 | 1.616 | 1.644 | 1.668 | 1.694 | 1.773 | 1.747 | 1.777 | 1.805 | 1.832 | 1.861 | 1.895 | 1.924 | 1.959 | 1.998 | 2.037 | 2.085 | 2.146 | 2.288 |
| 41 | 1.474 | 1.501 | 1.527 | 1.553 | 1.581 | 1.605 | 1.631 | 1.659 | 1.684 | 1.713 | 1.742 | 1.769 | 1.798 | 1.831 | 1.860 | 1.896 | 1.935 | 1.973 | 2.021 | 2.082 | 2.225 |
| 42 | 1.413 | 1.440 | 1.467 | 1.492 | 1.520 | 1.544 | 1.571 | 1.599 | 1.623 | 1.653 | 1.681 | 1.709 | 1.738 | 1.771 | 1.800 | 1.836 | 1.874 | 1.913 | 1.961 | 2.022 | 2.164 |
| 43 | 1.356 | 1.383 | 1.409 | 1.435 | 1.463 | 1.487 | 1.513 | 1.541 | 1.566 | 1.596 | 1.624 | 1.651 | 1.680 | 1.713 | 1.742 | 1.778 | 1.816 | 1.855 | 1.903 | 1.964 | 2.107 |
| 44 | 1.290 | 1.317 | 1.344 | 1.369 | 1.397 | 1.421 | 1.447 | 1.476 | 1.500 | 1.529 | 1.558 | 1.585 | 1.614 | 1.647 | 1.677 | 1.712 | 1.751 | 1.790 | 1.837 | 1.899 | 2.041 |
| 45 | 1.230 | 1.264 | 1.290 | 1.316 | 1.341 | 1.360 | 1.394 | 1.422 | 1.447 | 1.476 | 1.501 | 1.532 | 1.561 | 1.582 | 1.626 | 1.659 | 1.695 | 1.737 | 1.784 | 1.846 | 1.988 |
| 46 | 1.179 | 1.205 | 1.231 | 1.257 | 1.282 | 1.309 | 1.335 | 1.363 | 1.388 | 1.417 | 1.446 | 1.473 | 1.502 | 1.533 | 1.567 | 1.600 | 1.636 | 1.677 | 1.725 | 1.786 | 1.929 |
| 47 | 1.130 | 1.157 | 1.183 | 1.209 | 1.234 | 1.260 | 1.287 | 1.315 | 1.340 | 1.369 | 1.397 | 1.425 | 1.454 | 1.485 | 1.519 | 1.552 | 1.588 | 1.629 | 1.677 | 1.738 | 1.881 |
| 48 | 1.076 | 1.102 | 1.128 | 1.154 | 1.179 | 1.206 | 1.232 | 1.260 | 1.285 | 1.314 | 1.343 | 1.370 | 1.400 | 1.430 | 1.464 | 1.497 | 1.534 | 1.575 | 1.623 | 1.684 | 1.826 |
| 49 | 1.030 | 1.058 | 1.084 | 1.110 | 1.135 | 1.160 | 1.188 | 1.216 | 1.241 | 1.270 | 1.297 | 1.326 | 1.355 | 1.386 | 1.420 | 1.453 | 1.489 | 1.530 | 1.578 | 1.639 | 1.782 |
| 50 | .982 | 1.008 | 1.034 | 1.060 | 1.086 | 1.112 | 1.139 | 1.165 | 1.192 | 1.220 | 1.248 | 1.276 | 1.303 | 1.337 | 1.369 | 1.403 | 1.441 | 1.481 | 1.529 | 1.590 | 1.732 |
| 51 | .936 | .962 | .988 | 1.014 | 1.040 | 1.066 | 1.093 | 1.119 | 1.146 | 1.174 | 1.202 | 1.230 | 1.257 | 1.291 | 1.323 | 1.357 | 1.395 | 1.435 | 1.483 | 1.544 | 1.686 |
| 52 | .894 | .920 | .946 | .972 | .998 | 1.024 | 1.051 | 1.077 | 1.104 | 1.132 | 1.160 | 1.188 | 1.215 | 1.249 | 1.281 | 1.315 | 1.353 | 1.393 | 1.441 | 1.502 | 1.644 |
| 53 | .850 | .876 | .902 | .928 | .954 | .980 | 1.007 | 1.033 | 1.060 | 1.088 | 1.116 | 1.144 | 1.171 | 1.205 | 1.237 | 1.271 | 1.309 | 1.349 | 1.397 | 1.458 | 1.600 |
| 54 | .809 | .835 | .861 | .887 | .913 | .939 | .966 | .992 | 1.019 | 1.047 | 1.075 | 1.103 | 1.130 | 1.164 | 1.196 | 1.230 | 1.268 | 1.308 | 1.356 | 1.417 | 1.559 |
| 55 | .769 | .795 | .821 | .847 | .873 | .899 | .926 | .952 | .979 | 1.007 | 1.035 | 1.063 | 1.090 | 1.124 | 1.156 | 1.190 | 1.228 | 1.268 | 1.316 | 1.377 | 1.519 |
| 56 | .730 | .756 | .782 | .808 | .834 | .860 | .887 | .913 | .940 | .968 | .996 | 1.024 | 1.051 | 1.085 | 1.117 | 1.151 | 1.189 | 1.229 | 1.277 | 1.338 | 1.480 |
| 57 | .692 | .718 | .744 | .770 | .796 | .822 | .849 | .875 | .902 | .930 | .958 | .986 | 1.013 | 1.047 | 1.079 | 1.113 | 1.151 | 1.191 | 1.239 | 1.300 | 1.442 |
| 58 | .655 | .681 | .707 | .733 | .759 | .785 | .812 | .838 | .865 | .893 | .921 | .949 | .976 | 1.010 | 1.042 | 1.076 | 1.114 | 1.154 | 1.202 | 1.263 | 1.405 |
| 59 | .618 | .644 | .670 | .696 | .722 | .748 | .775 | .801 | .828 | .856 | .884 | .912 | .939 | .973 | 1.005 | 1.039 | 1.077 | 1.117 | 1.165 | 1.226 | 1.368 |
| 60 | .584 | .610 | .636 | .662 | .688 | .714 | .741 | .767 | .794 | .822 | .849 | .878 | .905 | .939 | .971 | 1.005 | 1.043 | 1.083 | 1.131 | 1.192 | 1.334 |
| 61 | .549 | .575 | .601 | .627 | .653 | .679 | .706 | .732 | .759 | .787 | .815 | .843 | .870 | .904 | .936 | .970 | 1.008 | 1.048 | 1.096 | 1.157 | 1.299 |
| 62 | .515 | .541 | .567 | .593 | .619 | .645 | .672 | .698 | .725 | .753 | .781 | .809 | .836 | .870 | .902 | .936 | .974 | 1.014 | 1.062 | 1.123 | 1.265 |
| 63 | .483 | .509 | .535 | .561 | .587 | .613 | .640 | .666 | .693 | .721 | .749 | .777 | .804 | .838 | .870 | .904 | .942 | .982 | 1.030 | 1.091 | 1.233 |
| 64 | .450 | .476 | .502 | .528 | .554 | .580 | .607 | .633 | .660 | .688 | .716 | .744 | .771 | .805 | .837 | .871 | .909 | .949 | .997 | 1.058 | 1.200 |
| 65 | .419 | .445 | .471 | .497 | .523 | .549 | .576 | .602 | .629 | .657 | .685 | .713 | .740 | .774 | .806 | .840 | .878 | .918 | .966 | 1.027 | 1.169 |
| 66 | .388 | .414 | .440 | .466 | .492 | .518 | .545 | .571 | .598 | .626 | .654 | .682 | .709 | .743 | .775 | .809 | .847 | .887 | .935 | .996 | 1.138 |
| 67 | .358 | .384 | .410 | .436 | .462 | .488 | .515 | .541 | .568 | .596 | .624 | .652 | .679 | .713 | .745 | .779 | .817 | .857 | .905 | .966 | 1.108 |
| 68 | .329 | .355 | .381 | .407 | .433 | .459 | .486 | .512 | .539 | .567 | .595 | .623 | .650 | .684 | .716 | .750 | .788 | .828 | .876 | .937 | 1.079 |
| 69 | .299 | .325 | .351 | .377 | .403 | .429 | .456 | .482 | .509 | .537 | .565 | .593 | .620 | .654 | .686 | .720 | .758 | .798 | .840 | .907 | 1.049 |
| 70 | .270 | .296 | .322 | .348 | .374 | .400 | .427 | .453 | .480 | .508 | .536 | .564 | .591 | .625 | .657 | .691 | .729 | .769 | .811 | .878 | 1.020 |
| 71 | .242 | .268 | .294 | .320 | .346 | .372 | .399 | .425 | .452 | .480 | .508 | .536 | .563 | .597 | .629 | .663 | .701 | .741 | .783 | .850 | .992 |
| 72 | .213 | .239 | .265 | .291 | .317 | .343 | .370 | .396 | .423 | .451 | .479 | .507 | .534 | .568 | .600 | .634 | .672 | .712 | .754 | .821 | .963 |
| 73 | .186 | .212 | .238 | .264 | .290 | .316 | .343 | .369 | .396 | .424 | .452 | .480 | .507 | .541 | .573 | .607 | .645 | .685 | .727 | .794 | .936 |
| 74 | .159 | .185 | .211 | .237 | .263 | .289 | .316 | .342 | .369 | .397 | .425 | .453 | .480 | .514 | .546 | .580 | .618 | .658 | .700 | .767 | .909 |
| 75 | .132 | .158 | .184 | .210 | .236 | .262 | .289 | .315 | .342 | .370 | .398 | .426 | .453 | .487 | .519 | .553 | .591 | .631 | .673 | .740 | .882 |
| 76 | .105 | .131 | .157 | .183 | .209 | .235 | .262 | .288 | .315 | .343 | .371 | .399 | .426 | .460 | .492 | .526 | .564 | .604 | .652 | .713 | .855 |
| 77 | .079 | .105 | .131 | .157 | .183 | .209 | .236 | .262 | .289 | .317 | .345 | .373 | .400 | .434 | .466 | .500 | .538 | .578 | .620 | .687 | .829 |
| 78 | .053 | .079 | .105 | .131 | .157 | .183 | .210 | .236 | .263 | .291 | .319 | .347 | .374 | .408 | .440 | .474 | .512 | .552 | .594 | .661 | .803 |
| 79 | .026 | .052 | .078 | .104 | .130 | .156 | .183 | .209 | .236 | .264 | .292 | .320 | .347 | .381 | .413 | .447 | .485 | .525 | .567 | .634 | .776 |
| 80 | .000 | .026 | .052 | .078 | .104 | .130 | .157 | .183 | .210 | .238 | .266 | .294 | .321 | .355 | .387 | .421 | .459 | .499 | .541 | .608 | .750 |
| 81 | — | .000 | .026 | .052 | .078 | .104 | .131 | .157 | .184 | .212 | .240 | .268 | .295 | .329 | .361 | .395 | .433 | .473 | .515 | .582 | .724 |
| 82 | — | — | .000 | .026 | .052 | .078 | .105 | .131 | .158 | .186 | .214 | .242 | .269 | .303 | .335 | .369 | .407 | .447 | .489 | .556 | .698 |
| 83 | — | — | — | .000 | .026 | .052 | .079 | .105 | .132 | .160 | .188 | .216 | .243 | .277 | .309 | .343 | .381 | .421 | .463 | .530 | .672 |
| 84 | — | — | — | — | .000 | .026 | .053 | .079 | .106 | .134 | .162 | .190 | .217 | .251 | .283 | .317 | .355 | .395 | .437 | .504 | .645 |
| 85 | — | — | — | — | — | .000 | .027 | .053 | .080 | .108 | .136 | .164 | .191 | .225 | .257 | .291 | .329 | .369 | .417 | .478 | .620 |

**To Calculate the Size (Kva) of Capacitor Required to Improve Power Factor**

**EXAMPLE:** Assume that from a wattmeter reading the total load input is 100 kw and power factor is 60%. It is desired to raise the power factor to 90%.

In left-hand column, locate 60% (original power factor). On a horizontal line extended to the right and in the column for 90% (desired power factor) find the factor 0.849.

Leading reactive kva required to raise the power factor to 90% is: 100 kw x 0.849 = 84.9 kva.

Thus, an 85-kva capacitor will be required.

*Further*, what would be the power factor if the next larger standard capacitor rating (100 kva) is used?

Another factor is determined by dividing the higher kva rating by the required reactive kva: 100/84.9 = 1.177.

From 60% (original power factor) in the left-hand column and on a horizontal line extended to the right, the factor 1.177 is found to be between the factor 1.31 in the vertical column for 98% power factor and sligthly less than 1.192 in the column for 99%.

Thus, the resulting power factor will be almost 99%.

**To Calculate the Size (kva) of Capacitor Required to Improve the Power Factor of a Given Motor to Unity (100%).**

**EXAMPLE:** Assume the motor to be 15 hp, 720 rpm, squirrel cage, with a full-load efficiency of 85% and power factor of 77%. Then, for the motor

$$\text{kw. input} = \frac{\text{hp. x } 0.746}{\text{eff.}} = \frac{15 \text{ x } 0.746}{0.85} = 13.16 \text{ kw.}$$

$$\text{kva. input} = \frac{\text{kw. input}}{\text{p.f.}} = \frac{13.16}{0.77} = 17.1 \text{ kva.}$$

$$\text{lagging reactive kva.} = \sqrt{17.1^2 - 13.16^2} = 10.95 \text{ kva.}$$

The leading reactive kva. of the capacitor neutralizes a corresponding amount of the lagging reactive kva. of the motor.

Thus, the size of the capacitor required is 10.95 kva.

In this case, it would be advisable to use the nearest standard rating, 10 kva., and the power factor would be over 99% or very close to unity.

*Courtesy of Cornell-Dubilier Electric Corp.*

magnetic fields as the fundamental principle of operation. As the excitation current is substantially constant, and useful current varies with the load, it can be readily understood that a low power factor will be produced when the motor is operated underloaded.

Low-speed motors have more poles than high-speed motors. For the same horsepower rating, greater excitation current is required, and the result is a lower power factor. So, because a.c. motors in most industrial and commercial applications run idle or only partly loaded for a considerable portion of the time, the average power factor is usually rather low.

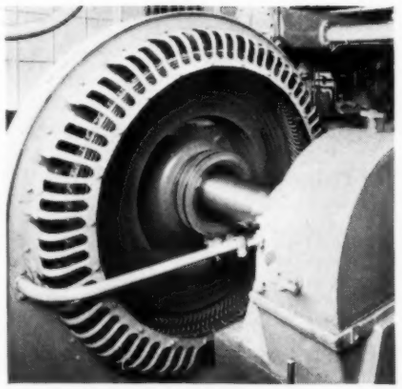
*Transformers* are used for voltage transformation, have an iron core, and require a magnetizing current in the same manner as induction motors. Thus, when a transformer without any load on the secondary remains connected to a line, it operates under lower power factor conditions. And, this is an important point for consideration—where a number of transformers are used and where large ones carry a light load continuously.

*Other inductive equipment,* such as arc and induction furnaces, a.c. magnets, spot welders, a.c. arc welders and gaseous-tube lamps, include reactive windings and draw a current of low lagging power factor. Fluorescent lamps require ballasts (high reactor transformers) for their operation. Uncorrected ballasts have a lagging power factor which might be as low as 55 per cent.

## 4. How to Measure Power Factor

In a well managed maintenance department periodic surveys of electrical systems include determining the power factor for the entire plant and in some cases for departments, specific machines or processes. Ordinarily the maximum power load or demand occurs when the largest number of motors are in operation with men at work on the machines. If during the period of maximum load, numerous meter readings are taken of volts, amperes and kilowatts, the power factor and maximum demanded are readily obtained. There are three methods for measuring power factor:

(A) To measure power factor of a single-phase circuit, a single-phase wattmeter, an ammeter and a voltmeter, with suitable transformers, depending on the current and voltage, can be used. For a polyphase circuit an additional single-phase wattmeter will be required or a polyphase wattmeter may be substituted for the two single-phase instruments. (For instrument connections see Maintenance Guide Sheet in ELECTRICAL CONTRACTING, March, 1939.) Also an industrial analyzer can be used, which is a combination of the above instruments in one case.



***LOW-SPEED** synchronous motor, 125 hp. 80 per cent leading p.f., 256 rpm., direct connected to a reciprocating compressor. Installation at Detroit Steel Products Co. raised over-all power factor 2 per cent. Improvement resulted in $600 annual saving in power costs. Better operation of other electrical apparatus was obtained through improved regulation of the electrical system. (Gen. Elec. Co. photo)*

The kw. load is measured directly by wattmeters. The kva is calculated from readings of the voltmeter and ammeter, and for a single-phase circuit is (volts × amp) ÷ 1000. For a 2-phase 4-wire circuit it is (2 × volts × amp) ÷ 1000. For 2-phase 3-wire, current in the common conductor is 1.41 times that in either of the other two conductors. For a 3-phase circuit it is (1.73 × volts × amp) ÷ 1000. Power factor = kw/kva.

(B) If an indicating or recording wattmeter is not available, satisfactory results may sometimes be obtained by utilizing the totalizing watthour (kwh.) meter, providing it may be read with reasonable accuracy over a period of 15 or 30 min. In this case, the kva would be obtained as before, that is, by means of a voltmeter and an ammeter; the kw. obtained by multiplying the 15-min. reading by 4, or the 30-min. reading by 2.

(C) A single instrument known as a power factor meter, either indicating or recording, can be used. When mounted and connected permanently to the main switchboard, as is the practice in many plants, it indicates the power factor for the entire plant. The same type of meter can be installed to measure power factor at other points in the plant.

***VOLTAGE REGULATION** at mine of Louisville Cement Co. of New York, Akron, N. Y., was so bad before correction of power factor that induction motors on machines in the main tunnel of the company's cement-rock mine could not be started without boosting by hand, which required several men, even when running-voltage levels were satisfactory. After connecting three banks of Westinghouse capacitors, effective current-carrying capacity was increased by 15 per cent, and voltage regulation was restored to satisfactory operating limits. Using capacitors to correct power factor from 57 to 95 per cent saves less than one per cent on the bill for electric energy, but cancels charges for reactive power demand. This saving is large enough to pay for the capacitors in approximately three years. One of the banks, 120 kva., is shown at right of illustration.*

## 5. Improving Power Factor

In a preliminary manner, a table for correcting power factor by the use of capacitors is given in the accompanying Maintenance Guide Sheet. The application of capacitors as well as other methods for improving power factor will be discussed in this section of the next issue of ELECTRICAL CONTRACTING.

# A LINE-UP FOR SERVICE

"3C" Bulletin 100, Type D, Heavy Duty Push Buttons, available in many combinations, are designed to meet every requirement of heavy industrial use.

There are no rivets! Screws hold all parts, including contacts. A screwdriver is used for all replacements and tightening.

And what contact flexibility! Two normally open and two normally closed insulated contacts can be provided on one unit without the use of flexible pigtails or similar devices.

Contacts are silver-to-silver—just another way of saying, "Long life and trouble-free service."

Protective Button Guards, easily removed if not desired.

Eight unit lengths are available in a single housing.

Large Knockout holes—what a boon when wiring multi-unit stations!

Slip-stream lines on simple, sturdy enclosures—no more skinned knuckles on sharp corners!

Selector Switches, Pilot lights, Mushroom head Buttons, two mechanically interlocked units, lock down device for single units, in any combination you wish! *Flush* mounted types, BACK-OF-BOARD mounting, also available. Dust Tight in accordance with NEMA definition 1C 50-28, Water Tight as per NEMA definition 1C 50-43, Oil Immersed for Class 1, Group D Hazardous Locations, are other types available.

**WRITE FOR FULLY DESCRIPTIVE FOLDER**

OFFICES IN PRINCIPAL CITIES

**THE CLARK CONTROLLER CO.**

1146 EAST 152ND ST. CLEVELAND, OHIO

# WE ARE MAKING

This G-E drawout switchgear with air circuit breakers protects 440-volt a-c feeders in a G-E factory

This enclosed breaker is being installed for the protection of a branch feeder to pump-motor circuits in the G-E Philadelphia Works

AS LOW AS $60.98 NET
for the G-E Type AE-1A
manually operated enclosed
air circuit breaker

Here is a G-E air circuit breaker installed with a 50-kva bench spot-welder in the G-E West Lynn Works

A group of four G-E air circuit breakers protect the branch feeders to electric furnaces in the G-E Philadelphia Works

G-E air circuit breakers protect the thyratron control and welding machines in the welding section of the G-E Philadelphia Works Laboratory

***Be Sure of Your IC with G-E Air Circuit Breakers***

# SURE OF OUR "IC"

**INTERRUPTING CAPACITY**

## *Are You Sure of YOURS?*

*HERE'S one case where the cobbler's children aren't going barefoot!* For more than a year we have been suggesting that you "Beware of mad short circuits" and that you "Be sure of your IC with G-E air circuit breakers." At the same time, we have been taking our own medicine. Right in the Philadelphia plant where they are made, we have been installing G-E air circuit breakers to protect feeders leading to welding machines, electric furnaces, machines in our woodworking shop—in fact, wherever adequate interrupting capacity is needed to protect personnel and equipment.

**Protect Men and Machines**

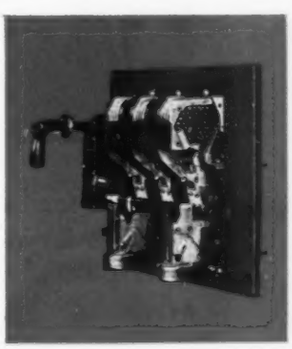
This program is well under way. Already, every resistance welding machine in the Philadelphia Works has been furnished with one of these breakers. And, the same program is being carried out in other G-E plants. Breakers are being installed to protect men and machines and to help maintain continuous production in our Schenectady, West Lynn, Pittsfield, and other Works. But we aren't the only ones who are recognizing the importance of providing plenty of IC. Operators of all types of industrial plants throughout the country are installing G-E air circuit breakers. Many who have provided this modern form of protection for one machine have already placed repeat orders for breakers to be used with other equipment.

**Play Safe with Short Circuits**

The severity of a short circuit depends largely on the capacity of the transformers that feed the circuit, and it can *not* be determined by the normal load on the circuit. As plant loads have grown, transformer capacities have been materially increased. Therefore, short circuits present an ever-increasing hazard. They gravely endanger personnel and property wherever the power supply has outgrown the interrupting capacity (IC) of the protective devices.

*G-E Air Circuit Breakers Are Available with Interrupting Ratings Up to 80,000 Amp*

Are you sure of *your* IC? With G-E air circuit breakers of *known* interrupting capacity, you *can* be sure. If you have any question about how to determine the interrupting capacity needed, in order to know the size of circuit breaker to use, get in touch with the nearest G-E office. General Electric Company, Schenectady, N. Y.



Type AE-1A manually operated breaker with side of arc quencher removed to show pins and contacts

**GENERAL ELECTRIC**

690-3

# *Look at the PLUS VALUES in the* NEW BRIEGEL METHOD CONNECTOR

**Constructed From Fine Sheet Steel** . . . making stronger, neater and more durable connections than ever. Impossible to split the tube end because of inbuilt tensile strength of the sheet steel.

**Larger Shoulder** . . . completely closing the knockout hole in the box.

**New, Improved Bonding-Type Lock Nut.**

**No Open Seam** . . . Lap seam construction makes all connections smooth and finished.

**NO INCREASE OVER PRESENT LOW PRICES.**

*Patents Pending*
*Approved by Underwriters Laboratories*

*Distributed By:*

The M. B. Austin Co., Chicago, Ill.
Clifton Conduit Co., Jersey City, N. J.
The Steelduct Co., Youngstown, Ohio
National Enameling & Mfg. Co., Pittsburgh, Pa.
Clayton Mark & Co., Evanstown, Ill.
General Electric Co., Bridgeport, Conn.
Enameled Metals Co., Pittsburgh, Pa.
Triangle Conduit & Cable Co., Elmhurst, New York City

**BRIEGEL METHOD TOOL CO., Galva, Illinois**

Bunting Electric Motor Bearings for replacement are easily and economically installed because they are made to the exact design and dimensions of the original equipment.

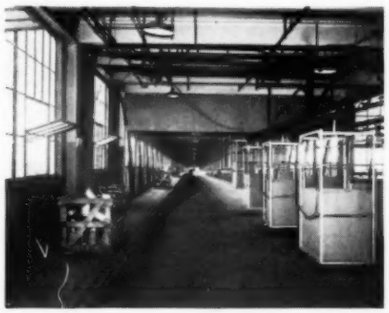
● Write for catalog of Bunting Bearings for all makes of motors from 1/50 to 100 hp instantly available from stock . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.


## Gear-Motors Used to Operate Conveyor

Three lines of conveyors housed in an industrial bridge approximately 1,000 ft. long were installed recently at the Mansfield, Ohio, plant of Westinghouse Electric and Mfg. Co. They are used to carry range and refrigerator bodies and parts from the metal stamping department to the enameling plant and back to the assembly departments.

Gear-motors drive a reversible belt conveyor. The stitched type belt is 32 in. wide; total amount for the system is approximately 2,400 ft. and is designed to handle a crate 58-in. long by 27-in. wide, and weighing 600 lb.

The belt conveyor system is divided into sections. It is served by a lowerator to handle material from the first to



***GEAR-MOTORS** are used to drive sections of the belt conveyor shown at left of illustration. Overhead chain conveyors are at the right. Interior view along part of the industrial bridge.*

***INDUSTRIAL BRIDGE,** more than two city blocks long, carrying three conveyor lines, connecting main assembly and vitreous enamel plants.*

third floor of one building, and is reversible.

First two sections of the belt conveyor, each 293-ft. long, are driven by 3-hp., 29-rpm. gear-motors. Third section, chain-driven live roller conveyor, driven from the second section, carries the crates around a 90-deg. turn. Next three sections, two 188-ft. long and one 164-ft. long, are driven by 2-hp., 32-rpm. gear-motors. Next section, chain-driven live roller conveyor, is for a 90-deg. turn and is driven from the preceding section. The last section consists of approximately 20-ft. of gravity roller conveyor and is not power-driven.

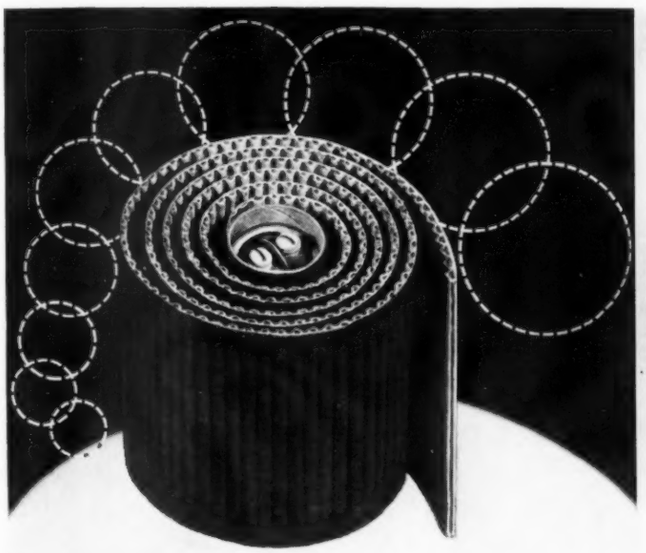
An over-and-return overhead chain

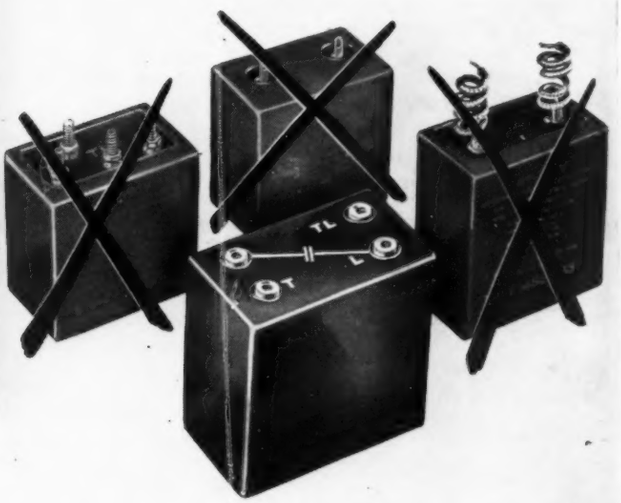
NEW

P. R. MALLORY & CO. Inc.

# MALLORY Universal AC CAPACITORS

## *will reduce your inventory more than half*






**ANY NEEDED DIAMETER OR HEIGHT IN A MATTER OF SECONDS**

**ONE CAPACITOR REPLACES ALL THREE**

Here's the greatest news about Motor Start Capacitors to ever hit the replacement field. Now replacements are completely simplified and your inventory investment to cover *every need* can be reduced as much as one-half to two-thirds. Round types MSU are all housed in the smallest diameter and shortest height metal container possible. Around each is wrapped a specially developed "size adjuster" providing a top diameter of 3" and a maximum height of 4¾". This corrugated adjuster is clearly calibrated for all smaller diameters and heights. You simply trim it at the desired point for a perfect fit.

Rectangular types MSG and MSF are each packed with complete hardware to cover every installation need. Mallory Universal AC Capacitors will cost you less and reduce your stock investment. Mallory's reputation in the Capacitor field is your guarantee of quality.

### *Send for Catalog*

Write today, giving your distributor's name, for Catalog M-801 for complete details and replacement recommendations.

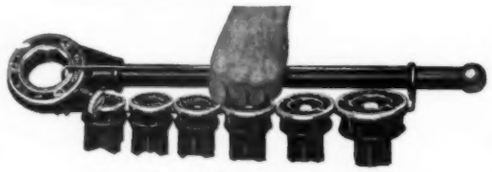
**P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA** • *Cable Address*—**PELMALLO**

P. R. MALLORY & CO. Inc.

MALLORY

You Cut Quicker Smoother Threads on Conduit with these new RIDGID Ratchet Threaders

IN a vise where it's handy or in a wall where it isn't, pipe or conduit to 1¼" is more efficiently threaded with a RIDGID. For the right size die head quickly snaps into the ratchet ring from either side, can't fall out, pushes out easily for changing. Or where pipe or conduit is close to wall, you simply reverse the dies—no special dies needed. Regular or conduit chaser dies of special tool steel are accurately ground for smooth threading, easily removed for regrinding. Three complete tools, Nos. 00R, 0R and 11R, give you the sizes you want, have patented carriers. To save work and money, ask your Supply House for the new all-steel malleable-alloy RIDGID Ratchet Threaders.



No. 11R Ratchet Threader for conduit and small pipe. Carrier conveniently holds ratchet ring and set of die heads.

Also 3-way threader 2 sizes, ¾" to 1". Same advantages as 0R.

THE RIDGE TOOL CO. ELYRIA, OHIO

RIDGID PIPE TOOLS



● THE NEW WAY TO DRILL HOLES IN CONCRETE, TILE, etc.

50-75% FASTER!

Amazing new drill-point contains special metal harder than hardest steel. Goes through concrete, tile, slate, porcelain, etc., 50 to 75% faster. Drills cleaner, more accurate holes. Speeds up installation of expansion anchors. Saves your skilled time for more profitable work. Eliminates noisy hammering, monotonous chiseling. Doesn't splinter fragile work. No special equipment needed—use in any rotary drill. Get *your* share of those extra profits now possible. Send coupon for leaflet.

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DETROIT, MICHIGAN

Carboloy Co., Inc.
11135 E. 8 Mile St., Detroit
Send free leaflet on Carboloy Masonry Drill-Points, for drilling concrete 75% faster.

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CARBOLOY
MASONRY DRILL-POINTS



"Easy does it"

This job especially requires hard blows struck softly and there are no better tools for safe pounding than

POUNDING IN WINDINGS

Chicago Rawhide Hammers and Mallets

Genuine Java Water Buffalo hide, treated, tightly coiled and compressed gives true, accurate blows without marring or damaging surfaces. Hammers with malleable heads and replaceable faces and Mallets properly weighted and balanced, are made in various sizes for every requirement. Your supply man will gladly demonstrate the efficiency and economy of these tools.

CHICAGO Rawhide MFG. CO.
1312 ELSTON AVE · CHICAGO · U·S·A·


conveyor system with suspended carrying baskets operates also on the industrial bridge. The speed is variable from 10 to 30 fpm. It is driven by a 3-hp., 1,160-rpm. motor, and provided with a 6-ft. diameter roll turn screw type take-up, with an additional spring type automatic take-up.

In addition the bridge has a 6-ft. aisle for electric trucks and pedestrians. The bridge eliminates the hazards of enamel chipping due to previous methods of transportation, and effects savings in factory costs that will return the investment in a period of three years.

## Portable Test Set Moved by One Man

A 2,200-volt testing transformer and accessories, weighing 200 pounds, was formerly equipped with handles and required two men to transport it in a New England shop.

By attaching casters to the 20- by 24-in. transformer platform and removing the handles, the test set can be moved to any location by one man.

The unit can be plugged into any 110-volt outlet and furnishes 2,200 volts for testing the insulation of coils for magnetic chucks and checking the electrical condition of bakelite parts.

An air circuit breaker is connected in the 110-volt line to the transformer and a pilot light shows when it is alive.

## Floodlighting Units For Corrosive Atmospheres

At this time of the year and with conditions requiring two and three work-shifts to get out production, adequate light is required. In certain areas floodlighting would be suitable.

Areas such as in electroplating plants, munition plants, breweries, railroad roundhouses and around impregnating tanks, pickling vats, and soaking pits have corrosive atmospheric vapors that would deteriorate material ordinarily used.

Lighting units are no exception from attack by extreme sulphuric atmosphere conditions, nor where they are subject to severe vibration.

To withstand such conditions, a complete lighting unit could be used that consists of a copper housing, inner aluminum reflector, cast bronze socket housing assembly, swivel for ¾-in. conduit mounting, and door assembly with heat-resisting spread-lens glass and gaskets to provide a vapor-proof and dust-tight seal.

Floodlighting units of this construction are available for use with 300- or 500-watt PS-40 Mazda general service lamps, and are furnished with 10-ft. of asbestos-covered cable.

## Welding Eliminates Warpage And Spots

Black spots appearing in the vitreous enamel over welds on light-gage steel refrigerator cabinets have been reduced by 90 per cent through use of an a.c. electric welding set. Frame warpage has been eliminated and welding time has been reduced.

In joining the cross members to the sides of refrigerator cabinets considerable difficulty was encountered with the acetylene welding formerly used. Due to the heat developed, the light 20-gage steel would warp out of shape, giving rise to large numbers of production rejects.

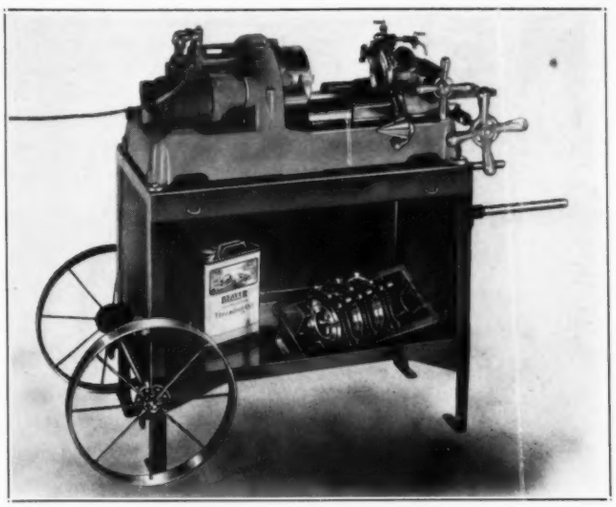
Another problem encountered was welding ends in the food compartment liners. These liners must be welded on

*A-C WELDING eliminates warping when cross rails are joined to sides of refrigerator cabinets, and reduced black enamel spots by 90 per cent (Westinghouse photos)*

the outside because the inside must take the familiar white vitreous enamel finish. With acetylene welding, after the enamel was applied, black spots often were found over the welded portions. This meant that these spots must be re-enameled in order to pass finish inspections.

A saving in welding time resulted, naturally cutting down the labor cost per cabinet. Total time required now, including handling, welding, and weld cleaning averages 60 to 65 seconds per man-hour of 50 cabinets.

Greatest saving, however, was the reduced enameling cost due to the 90 per cent less refirings now necessary to

highly efficient — low priced — portable — powerful — speedy — rugged

**Beaver Model-B**
**⅛ to 2-inch Pipe and Bolt Machine**

For ¼ to 2-inch pipe—¼ to 1½-inch bolts. Up to 8-inch with drive shaft and geared tools. Rack-and-pinion feed. Cast steel-iron base and cap. All-steel geared universal pipe chuck—with safety automatic wrench ejector; hinged full-range reamer; sliding wheel or knife cutoff; ring-type opening adjustable diehead—no hinge. Automatic gear-driven oil pump. All gears enclosed and run in oil. Choice of 110 or 220 volt universal reversible motor. Weighs about 280 lbs. In use in finest pipe shops throughout the country.
Write for Bulletin B.

BEAVER PIPE TOOLS
*Highest Quality* • WARREN, OHIO • *For 40 Years*
1140 DEEN AVENUE

JOHNSON *Leaded Bronze* ELECTRIC MOTOR BEARINGS

STANDARD or UNDERSIZE

*Distributors Wanted*

If you sell Electrical Supplies, investigate the profit possibilities in Johnson Electric Motor Bearings — no obligation.

● It's easier to do a better motor overhaul when you install Johnson Electric Motor Bearings. First, you have the largest selection of types on the market . . . . the most complete stocks. Next, all of the popular sizes are available as STANDARD or UNDERSIZE — whichever you may require. Finally, Johnson Bearings are correct in design and tolerance—so they slip easily into place. Write for a complete catalogue.

JOHNSON BRONZE
*Sleeve* BEARING HEADQUARTERS
490 S. MILL STREET • NEW CASTLE, PA.

# PAINE

## Spring-Wing TOGGLE BOLTS

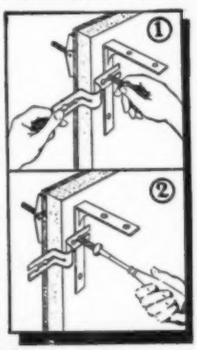
Cadmium Plated To Resist Rust And Corrosion.

**Are A Match For EVERY Anchoring Job In Hollow Material**

**Avoid costly "call backs" resulting from electrical equipment working loose by using PAINE Spring Wing Toggle Bolts that assure secure anchorage in all types of hollow material —including insulation and composition board, because, when expanded, the wing edges engage the bolt firmly preventing it from turning after installation. The wings are compressed when pushed through bolt hole and do not catch or jam. The strong spring beneath the wings automatically spreads each one independently to an anchoring position making the toggle effective where either or both wings can be spread. PAINE Spring Wing Toggle Bolts are available through your local Supplier in 9 different head styles—in standard lengths and diameters to meet all requirement.**

**FREE NEW PAINE TOGGLE BOLT CLAMP**

**Takes all of the headaches out of Toggle Bolt installation and cuts time and labor one-half. You simply follow ordinary Toggle Bolt installation procedure and, when bolt is ready to be tightened, you pull toggle tight against inside of wall, floor or ceiling—slip Clamp over bolt thread flush against equipment to be anchored, as shown in Fig. 1, and tighten with screw driver, as shown in Fig. 2. Look for this Clamp in your next box of PAINE Toggle Bolts—there are none better and this Clamp will give you the most up-to-date method of installation.**




PAINE — Ask your Supplier TODAY for PAINE Spring Wing Toggle Bolts and write for complete catalog of Anchoring devices for hollow and solid material.

**THE PAINE COMPANY**

**2961 Carroll Ave., Chicago, U.S.A.**

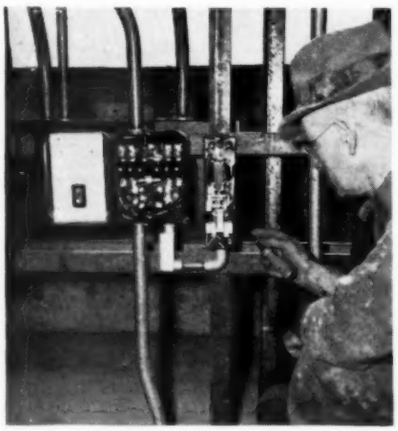
Eastern Warehouse & Sales: 48 Warren St., N.Y.


refinish black spots which show through the enamel finish. This is one more of the long line of successful applications which have been taken over by a.c. welding, and illustrates the savings obtainable in rejects, refinishing, and welding time; which all combine to produce lowered production costs.

## Relays Prevent Unnecessary Shutdowns

Time-delay relays have been designed to keep main motor contacts closed for 4 seconds after loss of line voltage. If full voltage is returned within that period, the motor will resume operation without requiring attention to start it. They are used with starters having the usual low-voltage and overload protection.

A number of such relays are used with automatic starters for main mill motors at the General Food Company's corn mill at Kankakee, Ill. They pre-



*TIME-DELAY RELAY maintains line connection for motors for 4 sec. after momentary loss of voltage, thus avoiding unnecessary shutdowns and resultant production delays.*

vent essential process drives from shutdowns by momentary loss of voltage and from making it necessary to hold up the entire plant until the electrician can start them again.

Essentially the relay consists of a solenoid energized by line voltage; its armature is connected mechanically, through an escapement wheel, to contacts which are closed when the motor is operating. On loss of voltage the solenoid is de-energized and the armature starts to drop out. The escapement wheel retards the movement of the armature, introducing a 4-sec. delay between de-energizing the solenoid coil and tripping of the contacts when the armature finally reaches the full "out" position.


*For Better Service—*

INSTALL **TRICO** REG. U.S. PAT. OFF.

**RENEWABLE FUSES**
With the famous Powder-Packed Element

**KLIPLOK CLAMPS**
Lock fuses and clips together

**KANTARK FUSES**
With genuine fibre tubes (not paper)

**COLORTOP PLUG FUSES**
The color tells the size

**FUSE PULLERS**
Pull and replace fuses safely

**GLASS OILERS**
For motors, line shafts, solid bearings etc

**UNBREAKABLE OILERS**
"Opto-Matic" Constant level type
Gravity Feed type

**WRITE FOR FOLDER CPF-300**

**TRICO FUSE MFG. CO., Milwaukee, Wis.**
In Canada: IRVING SMITH LIMITED, Montreal

**DRILL CONCRETE the Easy Way**

The old arm and hammer method is slow, hard and expensive. Use the Wodack "Do-All" Combination Electric Hammer and Drill and drill 15 times as fast in concrete and masonry. Two tools in one. With hammer member removed it's an electric drill with ½" chuck. Cuts cost of drilling for expansion anchors. Universal motor 110 or 220 v. Ask for Bulletin.

**WODACK ELECTRIC TOOL CORP.**
4628 W. Huron Street - Chicago, Ill.
Phone AUSTIN 9866

**NEW SpeedWay**

Not only far more for the money — actually more drill.

A tool and a price made possible by SpeedWay's 30 years' specialization in portable electric tools, and modern production methods. Every new feature: Streamlined, die cast case, forced air cooling, natural grip in line breast plate handle, removable side handle, sliding switch, waterproof cord, molded plug, and a stallproof specially wound, high torque, 500 RPM, 115 V Universal SpeedWay Drill Motor.

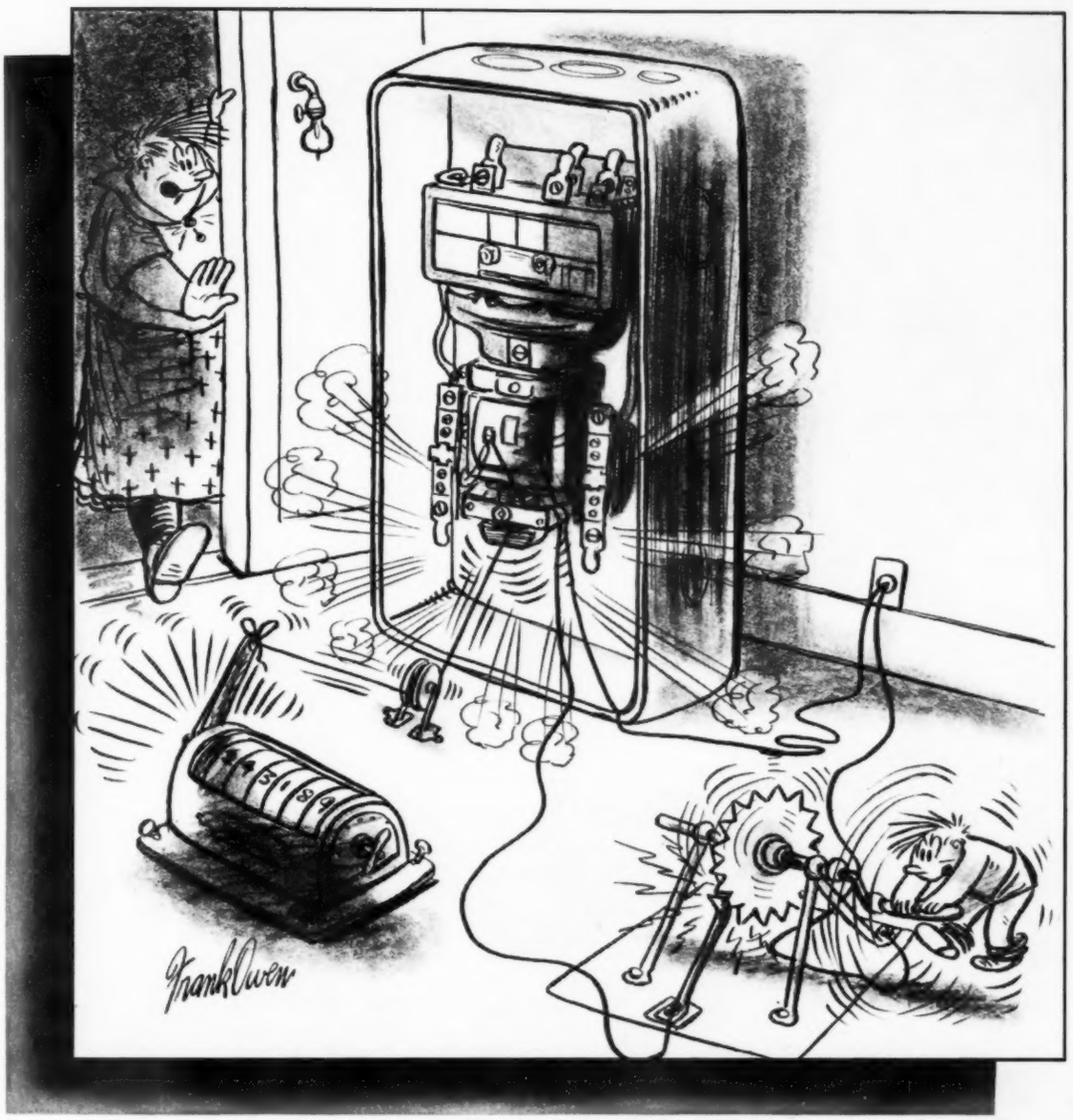
**1" DRILL**

If your dealer can't supply, order direct on 10 day trial.

**$24.50**

Circular Free

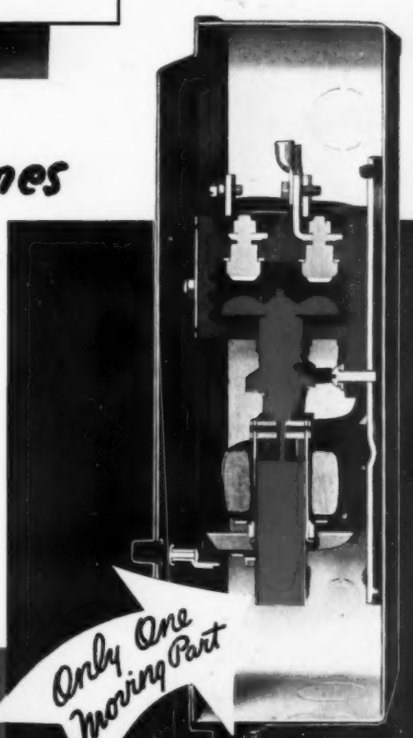
SpeedWay Mfg. Co., 1866 S. 52nd Ave., Cicero, Ill.




# "Better give up! It's worked millions of times and hasn't broken down yet!"

If you want motor control that will operate hundreds of times a day, year in and year out, without giving trouble, specify the Allen-Bradley solenoid starter. The secret of its trouble-free performance lies in the simplicity of the solenoid construction. There are no bearings, pivots, or complicated mechanisms to wear, gum up, or corrode.

The Allen-Bradley solenoid starter has double break, patented cadmium silver contacts which never need cleaning or filing. Dust does not affect their operation. The experience of all users demonstrates the ability of these starters to give long, trouble-free service. Try an Allen-Bradley starter on your next tough motor control job.




This cutaway view of the Allen-Bradley solenoid starter shows how the movable contacts and solenoid plunger form the only moving part. The plunger slides freely in its phosphor bronze guide. Friction-producing parts have been eliminated from this starter.

A-B

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

# SEVEN-YEAR SUCCESS OF A-B SOLENOID LINE

## *creates demand for the NEW SIZE 4*

**Maximum Rating**
**50 Hp, 220 V; 100 Hp, 440-550 V**

**These fundamental advantages of the Allen-Bradley solenoid construction are now available for much larger motors.**

**• NO CONTACT MAINTENANCE**
The double break, patented cadmium silver contacts never require ordinary cleaning or filing—a distinct advantage over copper-to-copper contacts.

**• GREATER SWITCHING CAPACITY**
The Allen-Bradley solenoid starter will easily and without much commotion interrupt currents of at least ten times its maximum horsepower rating.

**• SIMPLE, RUGGED CONSTRUCTION**
No other starter has so few moving parts. No pivots! No pins! No hinges! No complicated switch mechanisms!

**• LONGER LIFE**—With contact filing unnecessary and with only one moving part in the solenoid switch structure, the life of the starter is greatly increased.

**• UNIT CONSTRUCTION**—The switch is mounted on a metal base plate and is self-insulated. Hence, it can be quickly and easily mounted to metal surfaces without extra insulation.

**• ENCLOSED ARC HOOD**—The arc hood encloses the starter contacts and confines all arcing, allowing closer grouping of starters or contactors.

**• WHITE INTERIORS**—The patented white interior reflects light and illuminates the starter in dark corners. There is generous space for wiring.

**The Growth of the Allen-Bradley Solenoid Line**

**SIZE 1**—In 1933, Allen-Bradley announced the remarkably new and different solenoid starter.

**SIZES 2 and 3**—Encouraged by its success, the solenoid was extended to larger sizes.

**SIZE 0**—Last year this smaller solenoid starter was inserted in the line.

**SIZE 4**—Allen-Bradley offers a new development—SIZE 4—a still larger solenoid type starter.

*Send for New Bulletin 709-710*

Allen-Bradley Company
1307 S. First Street
Milwaukee, Wisconsin

Please send me a copy of your new "Bulletin 709-710."

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

# ALLEN-BRADLEY
## SOLENOID MOTOR CONTROL
QUALITY

# Keep Up-To-Date on new developments

## through this FREE SERVICE .....

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**CIRCUIT BREAKERS**

**1.** A 12-page illustrated catalog, listing and describing "De-Ion" air circuit breakers for load center, panelboard, switchboard or enclosure mounting. Westinghouse Electric & Mfg. Co.

**FLUORESCENT UNITS**

**2.** Two folders illustrating and describing the "Masterlite" for general and localized industrial lighting and the "50 Foot Candler", continuous fluorescent lighting for general illumination. The Miller Co.

**ELECTRICAL DEVICES**

**3.** Catalog consisting of 78 pages of data on switch boxes, outlet boxes, connectors, fittings, fixture studs, extensions, hangers, grounding assemblies, floor junction boxes, insulator supports and accessories. Steel City Electric Co.

**FLUORESCENT CONTROL EQUIPMENT**

**4.** Bulletin No. 402FL contains technical data on fluorescent lamp control equipment — ballasts, capacitors and switches. Bulletin 402LT covers luminous (Neon) tube transformers. Outdoor and indoor types are illustrated and specification data given. Jefferson Electric Co.

**SHOP EQUIPMENT**

**5.** Catalog 184 illustrates and describes shop boxes and stack-units for both handling and storage. All-Steel-Equip Company

**INFRA-RED EQUIPMENT**

**6.** Catalog No. 16 features infra-red equipment to bake, dehydrate or dry. Illustrations and descriptions are given. The Fostoria Pressed Steel Corp.

**CAPACITORS**

**7.** Catalog M-801 gives full details of motor starting capacitors for replacement use. Also replacement recommendations. P. R. Mallory & Co., Inc.

**MOTORS**

**8.** The "Small Motor Selector" guide (F-8525) contains all essential data needed to fit the right type motor to any job. Westinghouse Electric & Manufacturing Company.

**DISTRIBUTION SYSTEMS**

**9.** Bulletin No. 61 illustrates and describes distribution systems for light and power. It includes feeder busduct, plug-in busduct, plug-in devices and accessories. Frank Adam Electric Co.

**TELEPHONE SYSTEMS**

**10.** A 48-page catalog, No. 103, covers all types of private intercommunicating systems. Each of the nine major systems are described in detail; wiring diagrams and installation data are given. Connecticut Telephone & Electric Corp.

**PANELBOARD**

**11.** Circular No. 325 describes and illustrates Type MH multibreaker distribution panelboard, for automatic circuit breaker protection for power application. The Trumbull Electric Manufacturing Co.

**LIGHTING FIXTURES**

**12.** A folder featuring fluorescent Fleur-O-Lier lighting fixtures. Technical data and specifications are given. R & W Wiley, Inc.

**COMMUNICATION SYSTEM**

**13.** Bulletin outlining a new Teletalk system designed for lunch counter and restaurant service. Instructions for installation and specifications included. Webster Electric Co.

**OUTLET BOXES**

**14.** A folder featuring porcelain outlet boxes and covers. Many illustrations are shown and prices are given. Porcelain Products, Inc.

**PROTECTIVE CHECK LIST**

**15.** A folder entitled "Planned Protection" features a plant protection check list on protective lighting, lines of communication and protection against power failure. Graybar Electric Co.

**BURNISHER**

**16.** Bulletin Form 959 illustrates and describes the Ohio burnishing tool for rings and commutators. Specifications and prices are given. Ohio Carbon Company

**WIRE**

**17.** Book featuring "Dilec" Safecote marked and measured wire and all types of small diameter wire including synthetic. Engineering data is included. National Electric Products Corp.

**TRANSFORMERS**

**18.** Bulletin 401-PCT is devoted to power circuit air cooled transformers. Illustrations of various types are shown and suggestions for applications, winding diagrams, specification and dimension tables. Jefferson Electric Co.

**LIGHTING UNITS**

**19.** A 24-page catalog illustrating and describing the Miralume Line of fluorescent lighting fixtures. Hygrade Sylvania Corporation.

**CONTROLS AND BALLASTS**

**20.** A 4-page illustrated folder F-8505 describing and listing the complete standard line of fluorescent lamp controls, ballasts and capacitors for both single and multiple lamp luminaires. Westinghouse Electric & Mfg. Co.

**ENCLOSED SWITCHES**

**21.** Bulletin No. 59 illustrates and describes Shutlbrak enclosed switches, Type A interlocking and Type B non-interlocking. Frank Adam Electric Co.

**INSTRUMENT**

**22.** Folder GEA-2950 illustrates and describes the hook-on voltammeter, for measuring alternating current and voltage without cutting line or using separate current transformers. General Electric Co.

**INDUSTRIAL CATALOG**

**23.** Catalog No. 40 consists of 96 pages of data on the selection

and application of resistors, rheostats, tap switches, chokes and attenuators. Contains engineering data, reference tables, dimension drawings. Ohmite Manufacturing Co.

**RELAYS**

**24.** Bulletin GEA-1755C features photoelectric relays and accessories for counting, controlling, limiting and sorting. General Electric Co.

**LIGHTING UNITS**

**25.** Catalog No. 11 illustrates and describes architectural fluorescent and incandescent lighting fixtures for commercial and residential use. Kent Metal Manufacturing Co., Inc.

**VENTILATION**

**26.** A "pictograph" catalog illustrating and describing the features of new ventilating unit. Ilg Electric Ventilating Co.

**WELDERS**

**27.** Bulletin 402 consists of 58 pages of information on procedures for welding all metals. It is called "The Lincoln Weldirectory". Lincoln Electric Co.

**LIGHTING UNIT**

**28.** Folder illustrating and describing the "Indolier," a fluorescent reflector for use in industry. Industrial Light Sales Company

**TRANSFORMERS**

**29.** A series of folders on small transformer design and construction. Dimension tables and illustrations are given. Chicago Transformer Corp.

**FLOODLIGHTING UNIT**

**30.** Leaflet Section 61-150 describes the "Tufflite Concentrator" floodlighting unit designed for use with 300 or 500 watt type PS-40 lamps. Westinghouse Electric & Mfg. Co.

**WIRES AND CABLES**

**31.** Catalog B-40 illustrates and describes rubber insulated building wires and cables. Supplementary sheets cover small diameter wire; portable cords and cables; moisture resistant rubber covered building wires. Crescent Insulated Wire & Cable Co.

**VARNISHED TUBING**

**32.** A folder entitled "The Unvarnished Truth About Flexible Varnished Tubing." William Brand & Company

**INSTRUMENT**

**33.** Bulletin No. 300 illustrates and describes the Knopp load analyzer for making power factor and related measurements. Electrical Facilities, Inc.

**SAWS**

**34.** A booklet on "Doall Saws" explaining variables found in several types of narrow saws and case histories of testing jobs. The Doall Company

**PIPE TOOLS**

**35.** Two folders illustrating and describing pipe and bolt machines, threaders, ratchet sets, portable power unit. Beaver Pipe Tools

**SERVICE EQUIPMENT**

**36.** Bulletin No. 60 replaces bulletin No. 58 on service equipment, load centers and panelboards, assembled with AC circuit breakers. Frank Adam Electric Co.

**"QUICK SELECTOR" CATALOG**

**37.** The new 64-page "Quick Selector" catalog (30-000) simplifies selection of correct electrical equipment for any motor, lighting or feeder circuit. Safety switches, No-Fuze breakers, multibreakers, distribution panelboards, motors and motor controls are featured. Westinghouse Electric & Mfg. Co.

**LIGHT & POWER SYSTEMS**

**38.** Bulletin 403 outlines flexible light and power circuits for industrial plants and commercial buildings. Bull Dog Electric Products Co.

**FUSE**

**39.** Folder featuring the new Solar shock proof renewable cartridge fuse. Listings of various types and prices are given. Warren Lamp Co.

**TIME SWITCHES**

**40.** Bulletin No. 8401 illustrates and describes automatic synchronous time switches. Specifications and price list are given. Automatic Electric Manufacturing Co.

**LIGHTING FIXTURES**

**41.** Catalog No. A-101-40 describes fluorescent lighting fixtures for commercial and industrial use. Many illustrations are included. Watco Engineering, Inc.

**WIRES AND CABLES**

**42.** A 36-page booklet covering rubber covered wires and cables; service entrance cables, thin wall building wires and cables. Many tables and illustrations are shown. John A. Roebling's Sons Company

**ELECTRONIC DEVICES**

**43.** A 20-page booklet (GES-2411) entitled "Electronic Devices for Industry" lists some of the vacuum-tube appartus and describes its application. General Electric Co.

**LIGHTING FIXTURES**

**44.** Bulletin No. 20 illustrates and describes fluorescent daylight lighting fixtures for industrial and commercial use. Multi Electrical Mfg. Co.

**TIME SWITCHES**

**45.** Bulletin GEA-2963B features time switches for control of a.c. circuits, and for use in many industrial processes. General Electric Co.

**MOTORS**

**46.** Folder featuring Vari-Speed Jr. control, which converts constant speed motors into variable speed drives. Illustrations, rating tables and dimension diagrams included. Reeves Pulley Co.

**LAMP BALLAST**

**47.** Bulletin FL-58 announces the new W2-43 streamlined two lamp-ballast and starting compensator in single case. Sola Electric Co.

**EXPLOSION-PROOF FIXTURES**

**48.** A four-page bulletin, Form 1050, gives description of new explosion-proof sealed safety switches, receptacles and lighting fixtures designed for use in hospitals. Appleton Electric Co.

Circle numbers, sign and paste on a penny postcard or mail in an envelope.

**ELECTRICAL CONTRACTING** **November**
**330 West 42d St.**
**New York, N. Y.** **(Not good after January 1)**

**Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
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| 46 | 47 | 48 | | | | | | | | | | | | |

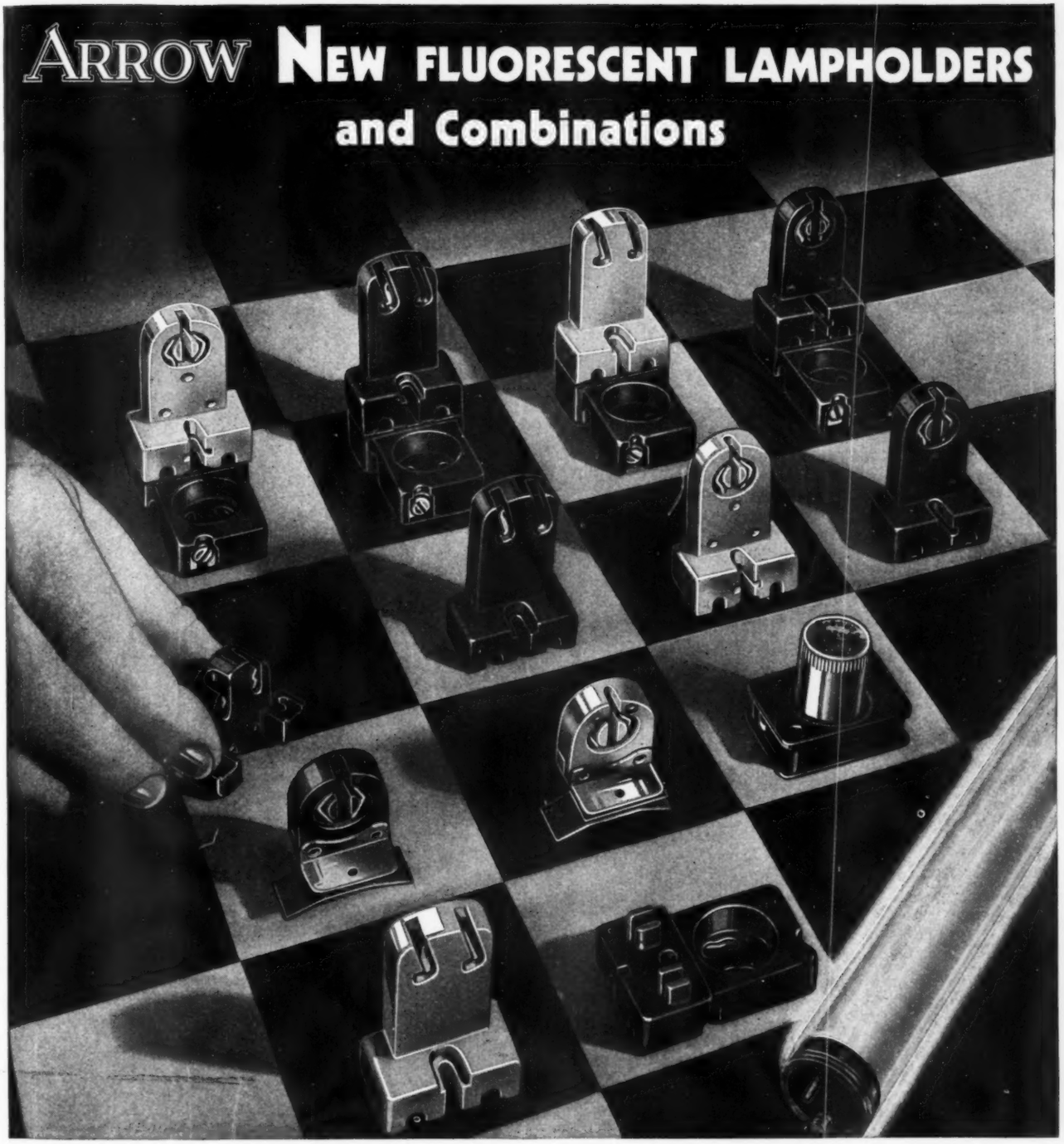
**NAME**..... **STATE**.....

**COMPANY** .....

**ADDRESS** .....

**CITY**..... **TITLE**.....

# ARROW NEW FLUORESCENT LAMPHOLDERS and Combinations



## *Your move now . . .*

to stock this line in competitive play for the new market! Fluorescent lighting, in a single year, has jumped to the front as the commercial-industrial illuminating value of the age. In stores, offices, workrooms, factories, this cool light of almost daylight intensity has brought a system of illumination outmoding all others — and brings to you a mounting demand for its own special wiring devices.

The new *complete line* pictured above includes black and white Bakelite devices of the handiest types. Starter sockets and lampholders may be had as separate devices, or in *combination* Socket-and-Lampholder as illustrated. The starter unit, when mounted, projects through the reflector or channel-surface directly below the lamp . . . *YOUR MOVE NOW* — to be *adequately* stocked for the new installation-requirements in this field.

SOLD THROUGH YOUR **ARROW ELECTRIC DIVISION** ELECTRICAL WHOLESALER

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

**FLOOR BOXES and WIRING SPECIALTIES**

**No. 284 Duplex Receptacle Nozzle**

With ½" brass pipe extension. Neatest and most compact fitting obtainable. Also available with ¾" pipe extension. Fullman also offers Duplex telephone Nozzles.

**No. 252-R Two Gang Box**

Two gang adjustable floor box with No. 208 receptacle in one section. One cover plate with ½" flush brass plug and the other cover with 2" flush brass plug.

**No. 110 "Latrobe" Watertight Box**

Cut-away view showing how tapered unit receptacle fits tapered opening in top of box body. The latest in design, appearance, and simplicity of installation.

• The *Latrobe Line* is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties

*Write for details TODAY!*

**FULLMAN MFG. CO.**

LATROBE • PENNA.


# More Gossip

## New Shop

New headquarters of the S. C. Sachs Co., St. Louis electrical contractors and engineers, has us eating a number of unpalatable words we have often had to say about the electrical contractor being a direct descendant of that shoemaker whose children went bare foot.

Two stories high, the remodeled building has large stock and storage facilities and a complete work shop on the first floor. The second floor offices are surrounded with sealed glass block windows, walls are finished in light knotty pine and all air conditioned. Indirect lighting measures 35 foot-candles with additional high intensity fluorescent lighting over drafting tables.

Electrically, this shop is a splendid example of what we are trying to sell to our customers. There ought to be many more like it in the industry.

And why not—we can buy it wholesale.

***COMPETITION IS MET** by Edward H. Kotz, president of Electrical Motor Repair Co., Trenton, N. J., by shop expansion and increased production efficiency. Ed has remodeled his plant to provide a larger office and sales display area as well as more room in his newly departmentalized shop.*

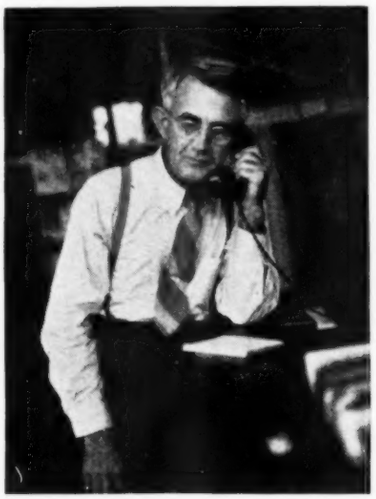
## Motor Shop Moves

The Standard Electric Motor Repair Co., Linden, N. J., is occupying its new and larger quarters at 1600 East Edgar Road (U. S. Route 1) in Linden. In addition to motor and apparatus repairing, this organization does electrical contracting work. G. A. Finger, formerly with Venino Brothers, Newark, N. J., is the shop superintendent.

## New Contractors in Wisconsin

Janesville has a new recruit in the electrical contracting business. Hugo J. Preuss, former manager of the Wisconsin Electric Sales Co., at Janesville, has opened his own business and will specialize in electrical contracting.

At Menasha, articles of incorporation have been filed by the Drucks Electric Service, Inc. This new organization will engage in the electrical repair and wiring business.



**PUBLIC SPIRITED**—*A. C. Loyd, president of Loyd Electric Company, San Antonio, Texas, finds time to be active in civic affairs. At present he is a member of the San Antonio Technical School Board of Education and to aid the cause of public instruction he offers to the students the facilities of his own shop for conducting electrical tests.*

## Money Makers

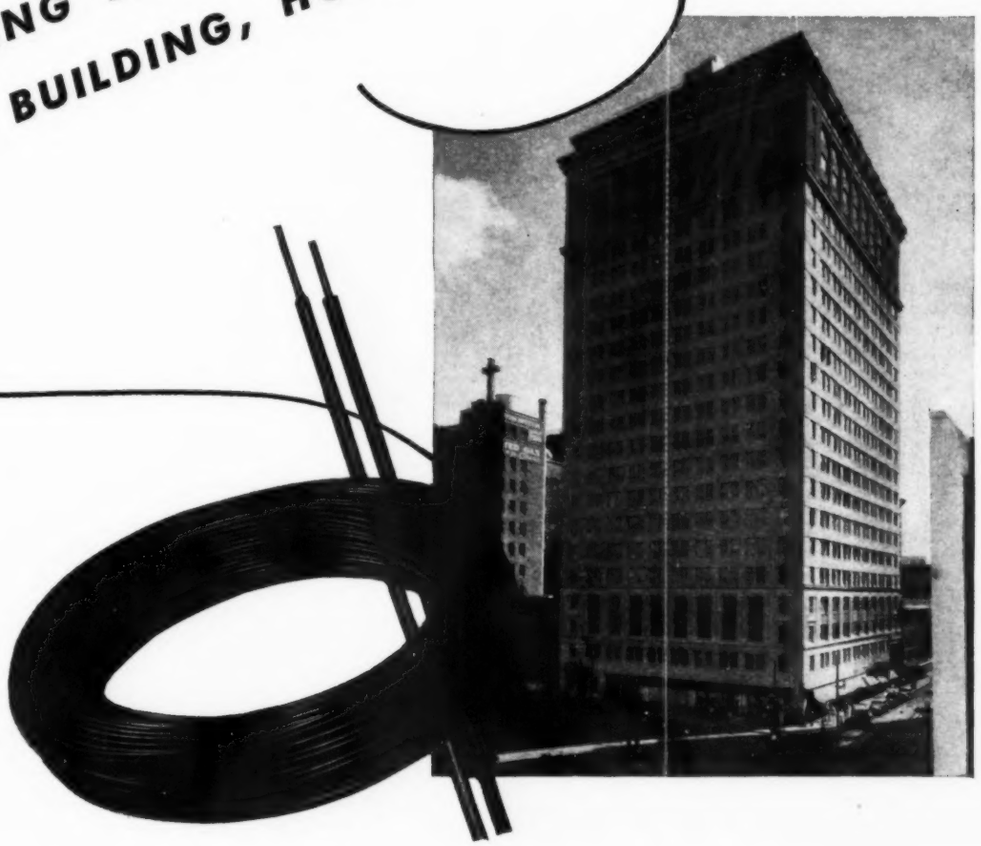
**1.** Just when electrical contractors are being exhorted to give home builders cheaper wiring, the same home builders want to replace nice cheap door bells with chimes at $5 and up—way up.

**2.** And then Bill Ritt tells us about the contractor in Minnesota who thought folks might like to give evening callers a critical glance before opening the door. He made a relay device which turns on the porch light automatically for a few minutes when the caller presses the doorbell. Home builders snapped them up at around $20 installed—and no haggling.

**3.** Another smart residential wiring contractor takes his customers' attention off competitive wiring quotations with a simple sound system from the kitchen or upstairs to the front and back doors. Little radio type speakers do the trick and the whole job runs around $35. The amplifier also doubles as an extra radio.

All this isn't adequate wiring, but a customer loosened up with a few obvious electrical conveniences is a push over for A/W. It looks like a tough winter for the price cutters.

# 100,000 FEET OF FLAMENOL* BUILDING WIRE USED TO REWIRE SHELL BUILDING, HOUSTON, TEXAS



**"ENTHUSIASTIC OVER SAVINGS"—SAYS BUILDING OWNER "EASY TO INSTALL"—SAYS ELECTRICAL CONTRACTOR**

The 14 upper floors of the Shell Building, Houston, Texas, have been rewired with Flamenol Small Diameter Building Wire to provide for increased illumination. The Shell Building is comparatively new. When it was opened 14 years ago its wiring was completely adequate according to the standards of that day. But today's lighting requires heavier wiring.

Consequently, the owners of the building, the New England Mutual Life Insurance Co., of Boston, Mass. wanted the wiring improved. They called upon the Jacobe Bros. Electric Co. to devise a satisfactory and economical way to bring the wiring abreast of the times. Jacobe Bros., incidentally, wired the building originally.

To solve the present problem, approximately 100,000 feet of No. 12 Flamenol Building Wire were used to replace the existing wires in existing branch circuit raceways. New risers were installed using five tons of G-E White Conduit and G-E Code Grade Building Wire. G-E Performance Grade Wire was used for main elevator feeders.

**New Life for Old Buildings**

Small Diameter Flamenol Building Wires enable wattages in existing buildings to be increased inexpensively. The present wires in existing conduits can be replaced with more wires or with wires of larger capacity. Flamenol Building Wire is available in sizes 14 to 4/0 inclusive. It is insulated with a plasticized polyvinyl chloride compound. This insulation is tough, flame retarding and is high in dielectric and mechanical strength.

For further information on Flamenol Building Wire and for samples, see the nearest G-E Merchandise Distributor or write to Section WF-0121, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

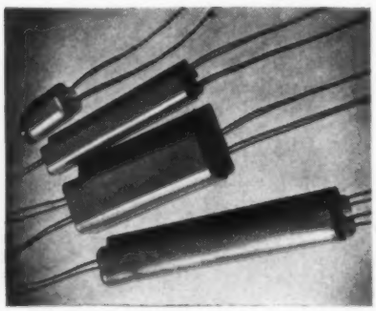
*Reg. U.S. Pat. Off.

**GENERAL ELECTRIC**

# EQUIPMENT News

## Lamp Ballasts

A new line of fluorescent lamp ballasts for use with separately mounted starting switches, has been developed. Ballasts are available for all sizes of lamps for either 50 or 60 cycle frequency on 110-125, 199-216 or 220-250 volts. Single lamp, normal or high power-factor ballasts and two lamp high power-factor ballasts to minimize stroboscopic effect. Chicago Transformer Corporation, 3505 W. Addison St., Chicago, Ill.



CHICAGO TRANSFORMER BALLASTS

■

## Remote Light Control

Light-O-Home control is a low voltage remote control for house lights which permits one to turn house lights on by pressing a button on dash board of car when in driveway. Consists of a control button and magnet on the car, a buried element in the driveway and a sensitive pick-up relay. Similar to dash board remote control for opening and closing garage doors. Also available with several additional bell type push buttons for remote control from garage, house or other building. Doors and Operators, Inc., Tiffin, Ohio.

LIGHT-O-HOME CONTROL

WESTINGHOUSE QUICKLAG BREAKER

## Thermal-Magnetic Breaker

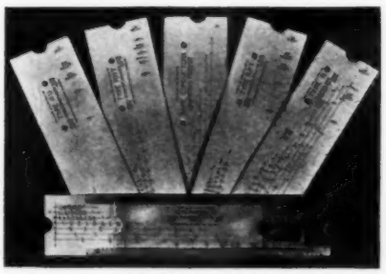
The "Quicklag" is a new small circuit breaker that combines in one unit a cooperative magnetic and thermal trip for instantaneous and time-delay opening. Magnetic action gives instantaneous trip on short circuits while the bi-metal thermal element gives time-delay on momentary overloads. Features are; no exposed live parts, permanent sealed calibration, low-resistant contacts, quick make and break operation, solderless terminals. Available in ratings of 15 to 35 amperes, single pole only, 250-volts a.c. and 125-volts d.c. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■

WIREMOLD FLUORESCENT UNITS

## Fluorescent Units

These wired and unwired fluorescent units are available in unit lengths for any specified size and number of fluorescent lamps, with or without Alzak reflectors of either concentrating or diffusing types. Wired units are supplied as standard with white plastic lamp holders, with channel and covers aluminum finish. New Wiremold controls, designed to fit within channel make a self-contained installation. Available fittings include hangers for ceiling, wall or special applications. The Wiremold Company, Hartford, Conn.



G-E WIROMETER

## Wire Calculator

A pocket-size wire calculator, called "Wirometer", has been developed for use in computing wiring problems in accordance with revised 1940 code tables of conduit and wire capacity. Information obtained by use of device includes: conduit fill of all approved types of building wires, including wires of different sizes in one conduit; current capacities for wires when more than three wires are run in one conduit; corrections in current-carrying capacity for ambient temperatures over 30 degrees C.; and voltage drop for eight distribution systems. It is 8-inches long, by 2⅜-inches wide and is made up of two sliding celluloid covers and six interchangeable cardboard slides. General Electric Co., Bridgeport, Conn.

■

## Combination Tool

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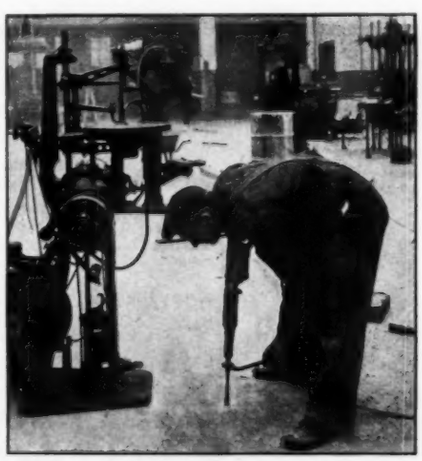


WODACK COMBINATION TOOL

# "Sell 'em" these NEW

# COLT MOTOR CONTROLS

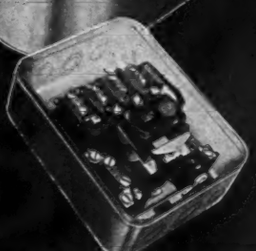
*for efficiency . . . appearance economy!*

**MANUAL STARTERS**
*with Automatic Toggle Mechanism*




**PUSH BUTTON STATIONS**
*Vertical and Horizontal Types*

**TWO-SPEED STARTERS AND REVERSING STARTERS**
*Manual and Magnetic*



**MAGNETIC STARTERS**
*with Three-Point Ball Bearing Action*

*Built To Do a Job for Industry*

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**COLT'S PATENT FIRE ARMS MFG. CO., Electrical Division, Hartford, Conn.**

# COLT MOTOR CONTROLS

Manual Motor Starters · Manual Reversing Starters · Manual 2-Speed Starters · Magnetic Contactors

Magnetic Motor Starters · Magnetic Reversing Contactors and Starters · Magnetic 2-Speed Starters · Combination Starters · Relays

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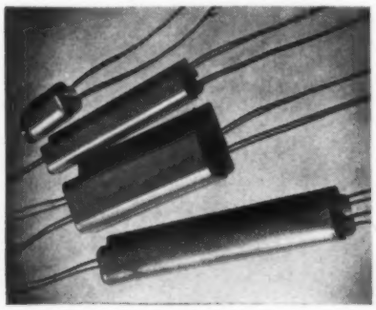

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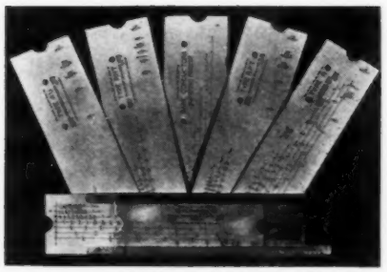

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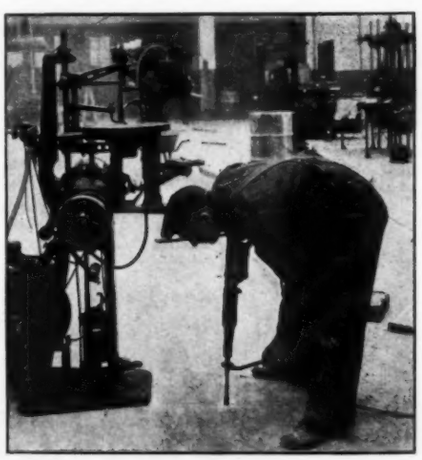

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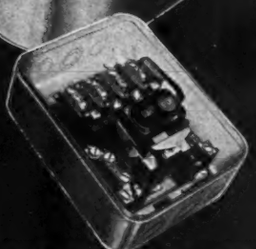

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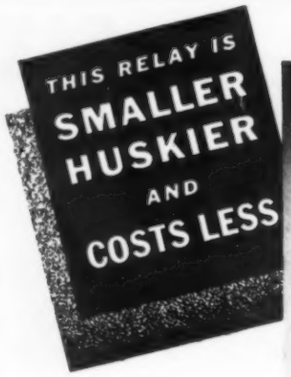
Magnetic Motor Starters · Magnetic Reversing Contactors and Starters · Magnetic 2-Speed Starters · Combination Starters · Relays



THE design of the new Ward Leonard Little Giant Single Pole Relay is simplicity itself. It is sturdily built yet there is not an ounce of material in it that is not essential to efficient performance. Measures only 1⅞"x2⅝". Controls ¾ H.P. on 115-230 volts. Ideal for heaters, pumps, compressors, signal lights, etc. Send for bulletins of interest.

RELAY BULLETINS

| | |
|---|---|
| Little Giant Relays.....Bulletin 105 | Heavy Duty Relays..Bulletin 131 & 132 |
| Midget Relays .....Bulletin 106 | Sensitive Relays .....Bulletin 251 |
| Intermediate Duty Relays..Bulletin 81 | Time Delay Relays..Bulletin 351 & 362 |

Visit our booths 225 and 226 at the Power Show,
Grand Central Palace, New York, December 2 to 7

WARD LEONARD
ELECTRIC COMPANY
28 SOUTH STREET MOUNT VERNON, N. Y.
ELECTRIC CONTROL DEVICES SINCE 1892

Effective-Correct FLUORESCENT WINDOW Lighting

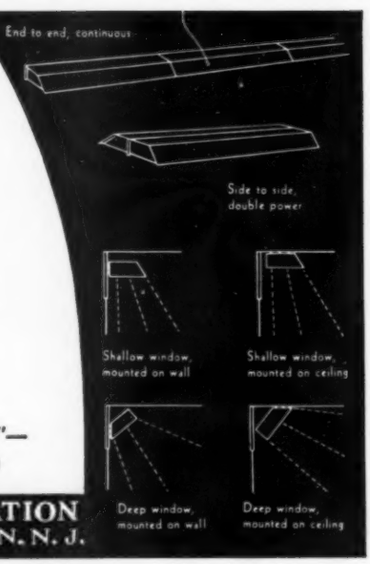
by EFCOLITE

M-292-48-H.P.
2-40 watt bulbs

Again . . . EFCOLITE LEADS with a scientifically designed FLUORESCENT WINDOW LIGHTING UNIT, that offers ease of installation and complete flexibility for all types of window lighting problems.

The low price of this compact and substantially constructed unit brings Fluorescent window lighting within the reach of progressive merchants everywhere.

*Cash in on this "Profit Opportunity"—*
*Send TODAY for Bulletin M-110*


End to end, continuous
Side to side, double power
Shallow window, mounted on wall
Shallow window, mounted on ceiling
Deep window, mounted on wall
Deep window, mounted on ceiling

EFCOLITE CORPORATION
TRENTON, N. J.


## EQUIPMENT News

[FROM PAGE 114]

### Pipe Machine

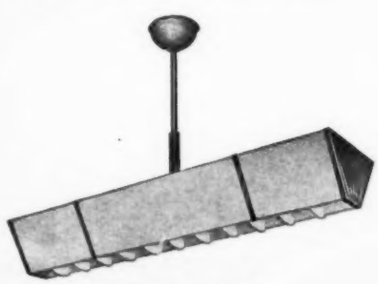
The "Pipe Master" No. 502 has been added to this line of portable pipe machines. It is equipped with new sliding, floating type of die-head, which is adjustable. Die-head is "front-cutting", which together with "close-gripping" front chuck handles nipples as short as 3½-in. in the 2-in. size without use of special nipple chuck. A cone fluted reamer is mounted on front of die-head. Machine is equipped with three jaw centering chuck on rear of spindle. Overall length is 46-in.; width 19½-in.; height 18-in. The Oster Manufacturing Co., 2057 East 61st Place, Cleveland, Ohio.

OSTER PIPE MACHINE

■

### Lighting Fixture

This fluorescent lighting fixture, known as the Beacon, is adapted for office and store applications. Four 40-watt fluorescent lamps are shielded by means of diffusing glass. Bottom of reflector is open. Direct view of lamps prevented by parallel louvers. Four lamps are mounted on curved metal reflector in which is housed necessary auxiliary equipment to operate fluorescent lamps with minimum stroboscopic effect and high power-factor correction. Decorations in end caps are illuminated through sheets of translucent plastic material. The F. W. Wakefield Brass Company, Vermilion, Ohio.



WAKEFIELD FIXTURE

# A CHALLENGE

★ ★ ★

Recently, the authors of an article appearing in a magazine with national distribution and under the subject of "Relative Costs of Various Types of Electrical Construction" described Knob and Tube Wiring as "An obsolete method of wiring, and in cases of overload it demonstrates the hazards of the cheaper systems of wiring"; they also go on to write, "Considering the dangers and the cost of making future additions to the electrical wiring, the knob and tube installation is the most expensive of them all".

***Such statements are unwarranted, damaging and deceptive and cannot go unchallenged by Electrical Contractors, Electrical Inspectors, the Electrical Industry and the many friends of Knob and Tube Wiring who have found it the ideal answer to their many wiring problems. We challenge the authors of the above statements to prove that their alleged findings are based on a thorough and exhaustive study of national safety conditions and wiring costs.***

The National Electrical Code, our highest authority on electrical wiring, not only recognizes both Open Knob and Tube Wiring and Concealed Knob and Tube Wiring as safe and practical systems, but in its 1940 Revisions covering carrying capacities of wires in raceways and in the open, the Code offers outstanding proof of the greater safety of Open Wiring on Insulators. The real losers, should damage be caused by an unsafe wiring system, are the Fire Underwriters—and they do not exact an extra premium from property owners whose premises are wired with Knob and Tube wiring systems. This is proof enough of the absence of hazards connected with Knob and Tube wiring systems.

OBSOLETE? Yes, if sunshine and rain are obsolete means for producing the harvest. Yes, if a straight line is obsolete as the shortest distance between two points. Yes, if 4 is obsolete as the sum of 2+2. The porcelain based wiring system will NEVER become obsolete as long as METAL is a CONDUCTOR of electricity, and as long as PORCELAIN and DRY AIR are INSULATORS. METALS are the best known conductors of electricity. PORCELAIN and AIR are the best known INSULATORS. Now put 2+2 together yourself. You arrive at only one answer, that is, *Porcelain Insulated Wiring System.*

COST? It has been our experience and that of thousands of qualified efficient electrical contractors that Knob and Tube wiring, considering both the cost of labor and materials, is installed more economically than any other wiring method known today. Costs of alterations and additions are based on practically the same figures as the costs for the original job. And we might point out to the authors of the above mentioned article that the costs of any particular wiring system does not "demonstrate the hazards of the cheaper systems of wiring". This statement, even to the layman, carries no logic, therefore, it is most certain not to ring true with qualified electrical contractors.

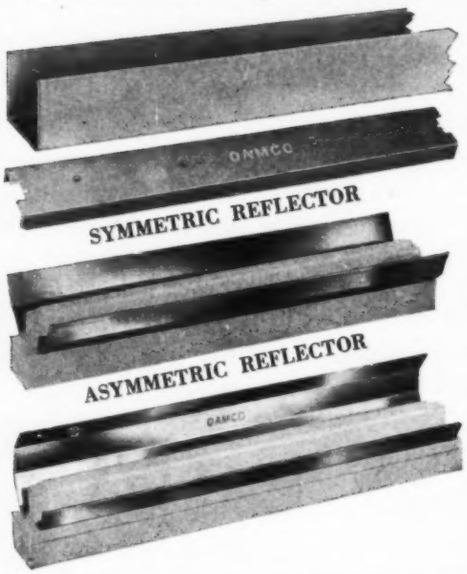
We invite expressions of opinion from all interested electrical contractors and electrical inspectors on this vitally important subject.

**PORCELAIN PRODUCTS, Inc.**
**FINDLAY, OHIO**

OAMCO REFLECTORS

The OAMCO line of Fluorescent Lamp Fixtures opens up many well-paying installation opportunities. They are Underwriters' Laboratories Approved—they are economical—highly efficient. Install them for work that requires good, clear, uniform lighting without the attendent high cost of Maintenance.

## Fluorescent Light Strips and Attachable Covers




Continuous lengths — made of 20 gauge galvanized iron, unfinished. For use with all types of single lamp auxiliaries, 2½" wide—1¾" deep. Also available are attachable covers, end caps, couplings, angle and cross fittings.

The symmetric and asymmetric reflectors shown here are made so they can be attached to continuous lengths and also single unit strips. They are finished aluminum laquor outside and reflecting side is white synthetic enamel.

Write today for the new OAMCO fluorescent catalogue No. 98 giving full details and listing many new items and price changes.

**OVERBAGH & AYRES MFG. CO.** 411 S. Clinton St., Chicago, Illinois.

## New LOW-COST UNIT

Converts Constant Speed Motors Into Variable Speed Drives

● The REEVES Vari-Speed Jr. is built to provide complete speed adjustability for light machinery. Uses any standard make motor from fractional to 1½ h.p. and any standard section "A" or "B" V-belt, depending on size. Efficient, simple. Merely install disc assembly on standard extension of motor shaft and mount motor on adjustable base. Disc assembly forms variable pitch driving pulley, which provides desired speed changes as motor is moved forward or back by handwheel. Made by recognized leader in speed control.

**DEALERS WANTED:** Entirely new profit opportunity for men who sell and service motors. Write for dealer proposition. Use coupon below.

## REEVES Vari-Speed Jr.

● *SEND FOR THIS VALUABLE FREE DATA FOLDER*

**REEVES PULLEY COMPANY,** *Department EC,* **COLUMBUS, INDIANA**
Send Bulletin telling all about the REEVES Vari-Speed Jr.

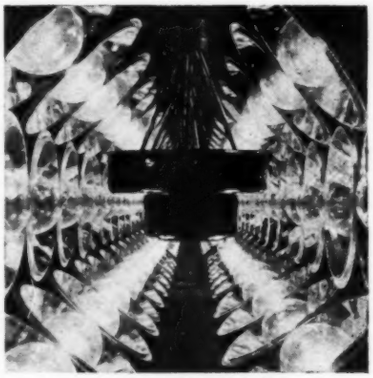
*Name* .....
*Company* .....
*Dept.* .....
*Address* .....
☐ Check here if you are an electrical dealer or contractor.

## EQUIPMENT NEWS

[FROM PAGE 116]

### Drying Lamps

A complete line of drying lamps designed to produce infrared (heat rays) instead of light. Available in 250-, 500- and 1000-watt units. There are two 250-watt lamps, one requiring special reflector equipment, as do the 1000 and 500-watt lamps; the other having its own reflector "built into" the bulb. Used to dry photo prints, industrial finishes of many kinds, food stuffs, paper products. Average laboratory life of lamps is in excess of 5000 hours. General Electric Lamp Department, Nela Park, Cleveland, Ohio.

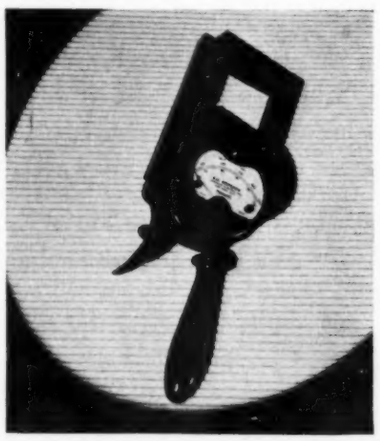


G-E DRYING LAMPS

■

### Instrument

A new improved dual range clipon ammeter has been developed. Rating is 0–100/500 amps. It is claimed to have a guaranteed accuracy of two per cent of full scale, and its clips are encased in bakelite. A hole is provided in handle of meter for a carrying strap. Ferranti Electric, Inc., 30 Rockefeller Plaza, New York, N. Y.

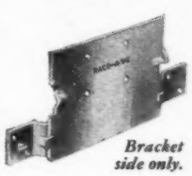


FERRANTI INSTRUMENT

# ACCEPTED!

## "RACO" ALL-STEEL SIDE MOUNTS

**HAVE MET WITH WIDESPREAD ACCEPTANCE FOR USE WITH WALLBOARD, SHEETROCK AND SIMILAR INSTALLATIONS**



*Bracket side only.*

Why put up with unsightly bulges, in an otherwise smooth wallboard installation, caused by the usual types of bracket boxes,—or

Why incur the additional expense of channeling to recess the usual type of bracket box in order to prevent these bulges?

Here's the way RACO•ALL-STEEL has eliminated another headache for the contractor.

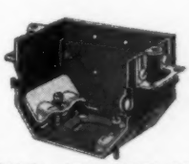
RACO•ALL-STEEL Side Mounts are mounted on the side instead of the face of the 2 x 4. The Side Mount Box may be spaced accurately for the thickness of the kind of board being used. It may be anchored temporarily, for checking, by means of the pointed projection provided. And then, in perfect alignment, fastened securely in its permanent position.

Where this type of installation is the exception, wholesalers may stock the bracket only. Assembly on RACO• ALL-STEEL rectangular boxes is quick and easy.

Experienced engineering keeps RACO•ALL-STEEL PRODUCTS in step with the wiring trends in every section of the country. They provide many advantages for rural and urban modernization work, as well as on new jobs. Write for your copy of the RACO•ALL-STEEL PRODUCTS catalog—there is no obligation.

***Distributed nationally by:***

**ALL-STEEL-EQUIP COMPANY**
**INCORPORATED**
**611 Griffith Avenue, Aurora, Illinois**
***Factories:*** **South Bend, Ind.; Aurora, Ill.**



*RACO • ALL-STEEL BEVELED CORNER SWITCH BOX for all types of non-metallic cables.*

*RACO • ALL-STEEL METALLIC CABLE BOX —3½" or 4" octagon with non-protruding clamp screws. Box may be installed on flat surface.*

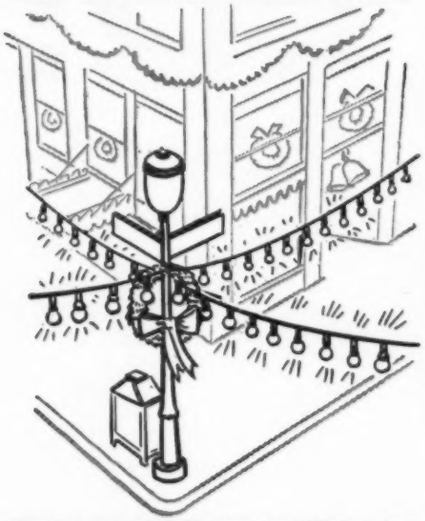
*RACO • ALL-STEEL BOX for sidewall bracket—2" vertical adjustment. Bridge is threaded for ¼" nipple and equipped with set screw.*

*RACO • ALL-STEEL 4" SQUARE BOX with mounting bracket. Simplifies the installation of switches and receptacles.*

*RACO•ALL-STEEL CABLE BOX—3½" or 4" octagon. Permits side or back entrance of all sizes of non-metallic cables.*

**RACO • ALL-STEEL • PRODUCTS**
**Switch Boxes • Outlet Boxes • Cutout Boxes • Cabinets • Conduit Fittings**
***Distributors in All Important Centers***

# G-E WIRING DEVICES FOR CHRISTMAS LIGHTING



Now is the time to see prospects for Christmas lighting jobs—stores, city officials, civic organizations, clubs, etc. General Electric has the special materials you'll need. Weatherproof sockets for outdoor festoon lighting! Angle adapters for floodlighting merchandise in stores and for 101 uses by churches, schools, etc.! Extension cords, twin taps, triple taps, multiple lampholder plugs!

The G-E pin-type weatherproof socket can be wired quickly. (Simply lay the wires in the grooves and screw on the cap.) G-E adjustable angle adapters permit wide adjustment. Some can be used in surface lampholder outlets. Others are mounted on box covers.

For further information about G-E wiring devices for Christmas decorations see the nearest G-E Merchandise Distributor or mail the coupon below.

General Electric Company
Section D-0121, Appliance and Merchandise Department
Bridgeport, Connecticut

Sirs: Please send me information on G-E wiring devices for Christmas decorations.

Name .....

Address .....

City ..... State .....

GENERAL ELECTRIC


## EQUIPMENT News

[FROM PAGE 18]

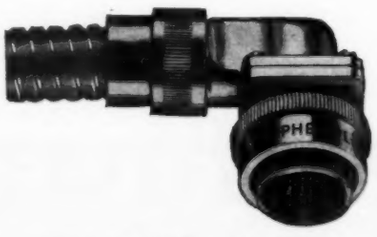
### Kitchen Fan

This kitchen ventilator features remote control and self-operating doors. Installation can be made over cooking range. By pushing switch, special door-operating motor goes into action, opening inside and outside doors and fan motor starts. Available in one standard size and constructed with adjustable wall sleeve. When fan is turned off, doors close, protecting it from rain, snow or dust. Autovent Fan & Blower Co., 1823 N. Kostner Ave., Chicago, Ill.

AUTOVENT KITCHEN FAN

### Connectors

A new "AN" series of electrical connectors for aircraft, marine, electrical, electronic, railway and industrial applications has been developed. "AN" shells are of aluminum, elements of high dielectric bakelite. Wiring may be done without removing elements from shells. Both shells and elements are arranged for positive polarization. Features include four type of shells in 18 different sizes for cables or conduit from 3/16-in. to 2½-in. O. D.; male and female elements having from one to 42 contacts with current carrying capacities from five to 200 amperes. The 90 deg. universal swivel plug permits setting of conduits or cables to clear obstruction. American Phenolic Corporation, 1250 West Van Buren St., Chicago, Ill.



AMERICAN PHENOLIC CONNECTORS

WOLVERINE SOLDERING LUGS

- *High-Conductivity*
- *Square-End*
- *Uniform Dimensions*

BUY FROM YOUR JOBBER

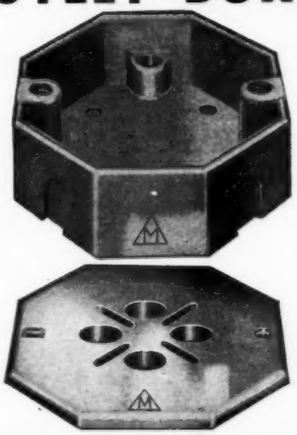
WOLVERINE TUBE CO.
DETROIT, MICHIGAN

*Profit by USING*

ILLINOIS

*Dependable Porcelain*

OUTLET BOXES



★ Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

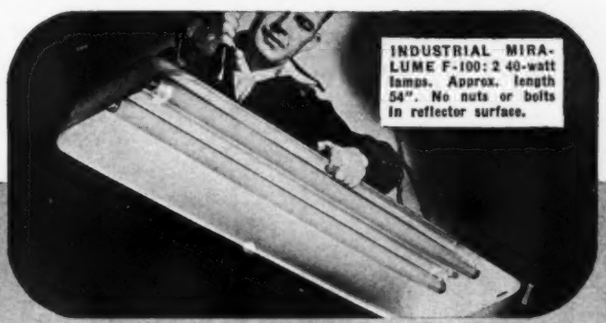
Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

# Extra Light-Giving QUALITY in Hygrade Fluorescent

## *pays you extra profits!*

COMMERCIAL MIRALUME HF-201: 200-watt unit: 4 40-watt lamps; approximate length 50".



INDUSTRIAL MIRALUME F-100: 2 40-watt lamps. Approx. length 54". No nuts or bolts in reflector surface.

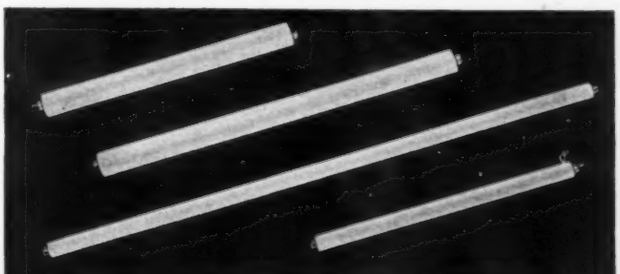
**Why risk your reputation on "cheap" fluorescent fixtures when you can convince your customers that it *COSTS LESS IN THE LONG RUN* for HYGRADE MIRALUMES?**

SO-CALLED "cheap" Fluorescent fixtures only *look* cheap. Before *you* sell *any* Fluorescent fixture, ask yourself what sort of service it will give *a year from now—two* years from now! If it's a cheap fixture, it means trouble *for* your customer and trouble *with* your customer!

**BUT**—with Hygrade MIRALUMES, you're selling QUALITY! For HYGRADE MIRALUMES are *better engineered throughout* and *completely guaranteed!*—lamps, fixtures and starters! Year after year, they give dependable service to your customer! That's why, in the long run, MIRALUMES COST LESS—to *buy*—and to *sell!*

***WRITE TODAY*** for free catalogue, with complete facts on Hygrade Fluorescent MIRALUMES and LAMPS. Address: Dep't EC11, Hygrade Sylvania Corp., Ipswich, Mass.

***SHOWN ABOVE*** are two MIRALUMES available. Designed, engineered, built, sold complete and *completely guaranteed* by HYGRADE! Supplied wired and ready to install, or unwired, if desired. Corrected for power factor and stroboscopic effect. Starters easily accessible. Underwriters Laboratory approved. Eligible for FHA financing.



Offer to test Hygrade Fluorescent Lamps against any other lamps in *any* fixture. Tape over the maker's name on both sets of lamps. Then let the customer make *his own* choice! (Our own men have used this test with sensational results!)

**NOTE:** Extraordinary lighting efficiencies are obtained in fluorescent lamps, and by tuning the electric discharge to concentrate ultra-violet energy at the precise 2537 Angstrom Unit wavelength most effective in causing the porous film (Hygrade patent 2096693) to generate light, the best results are secured. The means for achieving these results so important to the efficiency of HYGRADE LAMPS, are described in patent numbers 2126787 and 2201817 now controlled in this field by HYGRADE. The high power factor non-stroboscopic circuit used in this unit is described in Hygrade patent No. 2195114.

*Fluorescent at its Finest—*

**Lamps Hygrade Miralumes**

LOW COST · MORE LIGHT · Hygrade · FULL LIFE

Hygrade Sylvania Corp., Est. 1901. Makers of Hygrade Incandescent Lamps and Sylvania Radio Tubes

Copr. 1940 Hygrade Sylvania Corp.

# The DAWN of a NEW ERA

for

**Electrical Contractors**

Fluorescent Lighting appeals to the public . . . they want it.

The Public will buy Fluorescent from those Electrical Contractors who convincingly prove to be BEST EQUIPPED in knowledge and ability . . . and who give the finest service.

Tell your public why they can now get REAL light . . . that they may use three or four times as much light . . . *with less current wasted in heat.*

Tell your prospects why you install HIGH POWER FACTOR Fluorescent Lighting . . . why you use *DONGAN CONTROLS.*

Valuable information is contained in the booklet . . .

*"Jonnie Dongan Tells All On POWER FACTOR"*

Ask your WHOLESALER . . . or write us for complimentary copy.

# DONGAN TRANSFORMERS

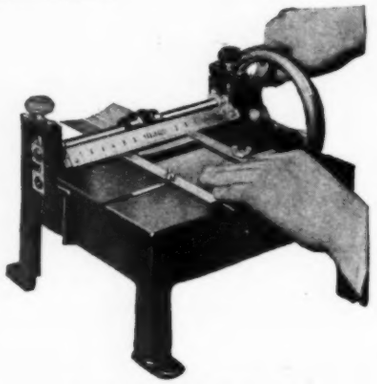
DONGAN ELECTRIC MFG. CO.
2981-2991 Franklin Street
DETROIT • U.S.A.
*"The Dongan Line Since 1909"*


## EQUIPMENT News

[FROM PAGE 120]

### Insulation Former

This former is for either plain or cuffed insulation of any length up to 8-in. in width. Machine operates by turning hand crank while insulation is guided between rubber roller and two creasing rollers by two aluminum brackets. Any desired width of trough up to 1½-in. may be obtained by adjusting span between two steel creasing rollers. Roller assembly is also adjustable for position of trough on insulation. Ideal Commutator Dresser Co., 1041 Park Ave., Sycamore, Ill.

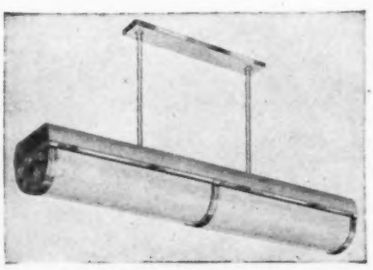


IDEAL INSULATION FORMER

■

### Luminaire

This fluorescent luminaire, type CL-110, is for commercial interiors, such as stores, offices and public buildings. Available for ceiling or suspension mounting, with or without "Alvax" glass. Suspension type uses two 40-watt 48-inch fluorescent lamps for downward illumination and one 30-watt, 36-inch lamp for indirect component. Ceiling mounted unit uses only two 40-watt, 48-inch lamps, either daylight or white. Lamp starters are the glow switch type. Twin lamp ballasts with built-in capacitors provide high power factor. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE LUMINAIRE

# What B.R.* Users say:

**COAL COMPANY . . .**
*"We make continual use of it in connection with our mining apparatus and supplies purchases."*

**TYPEWRITER MANUFACTURER...**
*"This book is used to locate sources of supply on our electrical equipment and machinery, and our electrician feels that he would be lost without it."*

**INDUSTRIAL CONTRACTOR . . .**
*"Our best indication of the use to which we put this book is the fact that last year's volume is almost completely worn out through continuous use."*

**ELECTRICAL CONTRACTOR . . .**
*"I do not believe a week has gone by that we do not use it five or six times."*

**POWER AND LIGHT COMPANY..**
*"Within five minutes after receipt we had used it for reference regarding the availability of truck mounted ladders."*

Check them off—active electrical men . . . contractors . . . men in every type of plant . . . in utilities, coal companies . . . they all find the Electrical Buyers Reference *valuable* because they *use* it . . . in a dozen different ways, maybe, but always to find that particular bit of buying information . . . and to find it *quickly, efficiently.*

USE your copy of BR* today, and like the men quoted above, find out how valuable this reference volume can be in *your* business.

***ELECTRICAL BUYERS REFERENCE**
**330 West 42nd Street, New York City**

Some of the many industrial and commercial FLEUR-O-LIERS now available in a wide variety of prices and sizes

## Open doors to greater sales opportunities—sell fluorescent in

# Certified★ FLEUR-O-LIERS

Joe isn't a super-salesman. But his boss is an *opportunist.* He can spot a red-hot item a mile away. And fluorescent indoor daylight in a Certified★ FLEUR-O-LIER is that kind of a product!

### *Your Prospect:* A Vast Industrial and Commercial Market

Stores, offices and factories of all types represent a large and swiftly growing market for fluorescent in Certified★ FLEUR-O-LIERS . . . fixtures made by over 35 leading manufacturers to employ the new MAZDA "F" (fluorescent) lamp at its highest efficiency.

### *Here's Why You'll Be Interested In Selling* Certified★ FLEUR-O-LIERS

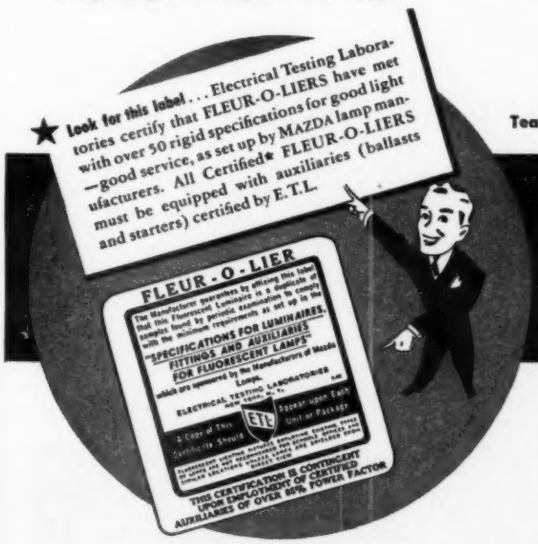
**You can sell a nationally advertised product.** FLEUR-O-LIER advertising in Saturday Evening Post, Time, Newsweek and 15 trade and business publications has been helping to *pre-sell* your customers.

**You can sell a high quality product.** FLEUR-O-LIERS are built to over 50 exacting specifications established by MAZDA Lamp manufacturers for electrical and mechanical excellence.

**You can sell a certified product.** FLEUR-O-LIERS are *certified* by Electrical Testing Laboratories as conforming to the above MAZDA Lamp manufacturers' specifications.

**You can sell with confidence** that Certified★ FLEUR-O-LIERS will give your customers good light and good service.

**Tear out and mail the coupon for complete information, including list of manufacturers.**


★ Look for this label . . . Electrical Testing Laboratories certify that FLEUR-O-LIERS have met with over 50 rigid specifications for good light —good service, as set up by MAZDA lamp manufacturers. All Certified★ FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E.T.L.
FLEUR-O-LIER
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
ETL
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

# FLEUR·O·LIER *Manufacturers*

Whenever you buy fluorescent lighting . . . Insist on CERTIFIED FLEUR-O-LIERS

**FLEUR-O-LIER MANUFACTURERS • 2122 Keith Building, Cleveland, Ohio**

Please send me helpful information about Certified FLEUR-O-LIERS, packages of indoor daylight for stores ☐ offices ☐ factories ☐

Name _____

Address _____

City _____ State _____

SELL "Style-plus" WITH

# SILVRAY

Here's a commercial lighting unit that will satisfy the most critical standards of good taste. Modern without being radical, it will sell itself to those who want good looks *plus* good seeing.

This Silvray Plasticon Luminaire (No. 210-PL) is designed for use with 750- and 1000-watt silvered bowl lamps with a luminous bowl of modern plastic (25-in. diameter). Special design of lamp ring assures efficient ventilation. Lamp neck fully concealed by matte-aluminum shield which rests on bowl supports. Suspension finished in cadmium. Overall length may be quickly adjusted on the job. Ball swivel joint in canopy assures straight hanging.

For complete information on this and other popular items in the Silvray line, write for catalog. Remember, too, that GRAYBAR is "Headquarters for fluorescents" for commercial or industrial applications. Graybar Electric Co., Graybar Bldg N. Y.

**Offices In Over 80 Principal Cities**

Graybar — Everything Electrical — Graybar Electric Company


## EQUIPMENT News

[FROM PAGE 122]

### Automatic Timer

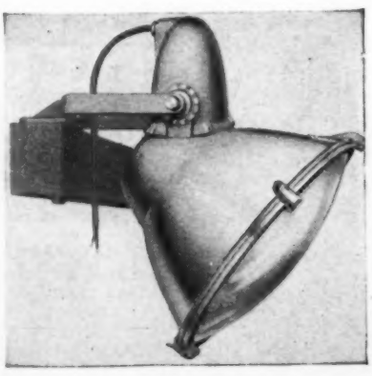
A new series of interval timers and time delay relays has been designed for many types of electrical equipment which must be timed in split seconds, seconds, minutes or hours. They are powered by slow-speed, self-starting synchronous motors and equipped with silver contact micro-switches. Manual or automatic reset models for built-in flush panel mounting, enclosed surface mounting or wall mounting. Paragon Electric Co., 37 West Van Buren Street, Chicago, Ill.

PARAGON TIMER

■

### Floodlight

The new "4200" series enclosed floodlight has been added to this line of service station units. A reflector of Alzak aluminum is used with choice of etched or polished surface for wide or narrow beam. Some of the features are degree markings for set focusing; hinged lens and cover for access to lamp and interior; wide range of adjustments vertically as well as horizontally. Vertical burning lamps are used for 750, 1000 or 1500 watts. Interior of unit is protected by asbestos gasket embedded in rim of reflector. Revere Electric Company, 207 North Paulina Street, Chicago, Ill.



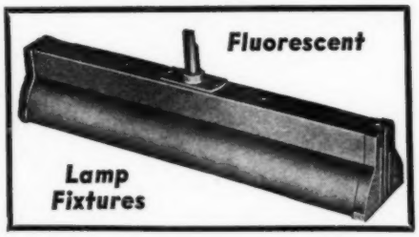
REVERE ENCLOSED FLOODLIGHT


# MULTI

Industrial Reflectors

AND

Fluorescent Lamp Fixtures



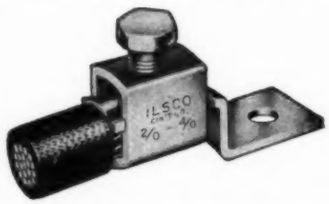
Greater and faster production in industry demands the very best in lighting equipment. MULTI Fixtures are right for any lighting need, whether for general, detailed, indoor, or outdoor. The MULTI line is complete. You can always get the proper unit for the job in factories, office, shops, or the home. Countless opportunities are open for contractors and they can get a good share of business with MULTI Reflectors to help. Let us send descriptive literature.

**MULTI ELECTRICAL MANUFACTURING CO.**
1840 W. 14th St. Chicago, Ill.

# ILSCO
SOLDERLESS CONNECTORS

## HAVE YOU TRIED The New Ilsco Lugs?

**BUILT FOR OVERLOADS!**

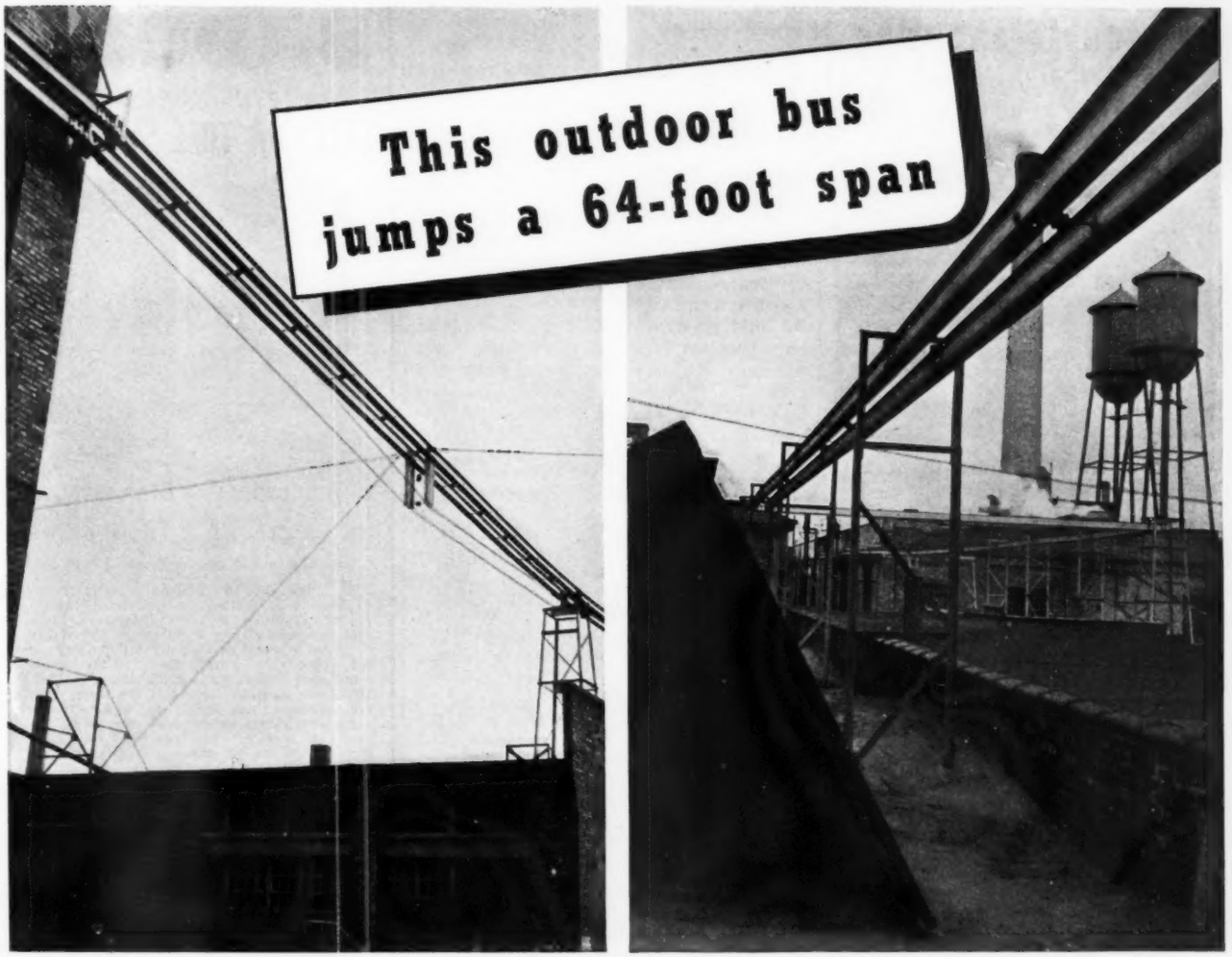


The new design — as passed by the Underwriters' Laboratories May 1, 1940.

Write for Samples today, —Along with the New Catalog.

*.....No Obligation.....*

**ILSCO COPPER TUBE AND PRODUCTS, INC.**
5629 MADISON ROAD — CIN., O.



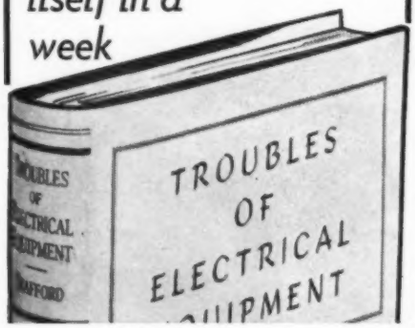

Two 8-inch Alcoa Aluminum channels, bolted back to back, form each leg of this bus installation. The natural stiffness of the channels permitted the use of long spans. Where the bus jumps sixty-four feet across a street and a railroad track, simple truss construction was used.

The bus runs 430 feet, indoors and out. Aluminum was chosen because it offered the best combination of mechanical and electrical characteristics. It has high current-carrying capacity.

Light in weight, Aluminum buses—tubular, flats, channels or angles—place less burden on supports. Structures can be lighter, with the result that you save money all around. Standard construction methods and simple, inexpensive fittings are used with Alcoa Aluminum buses.

ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pennsylvania.

**A trouble-shooting tool**—*that will pay for itself in a week*




- **SHOWS HOW TO QUICKLY LOCATE** motor troubles—transformer troubles—circuit breaker and relay troubles—troubles of lightning arresters—insulation troubles—voltage-regulator troubles—cable troubles.
- **SHOWS HOW TO DIAGNOSE THEM ACCURATELY**
- **SHOWS HOW TO CORRECT THEM**

This book brings you in compact, usable form practical pointers and trouble charts that you will use the first day you get the book in your hands.

**TROUBLES OF**

**ELECTRICAL EQUIPMENT**

*Their Symptoms, Causes and Remedy*

**By H. E. Stafford**
*Consulting Engineer*

**JUST OUT**

**New 2nd Edition Revised and Enlarged**

**373 pages, 6x9, 330 illustrations 25 tables, $3.00**

This book covers the symptoms, causes and remedy of troubles of both a-c and d-c apparatus usually found in the average industrial plant. Includes priceless practical hints on efficient operation and maintenance. A practical, how-to-do-it book that is an indispensable job manual for the electrical maintenance man. All formulas illustrated by practical examples and all technical terms explained in everyday English.

*Mail this coupon today for*

**10 DAYS' FREE EXAMINATION**

McGraw-Hill Book Co., Inc.,
330 W. 42nd St., N. Y.

Send me Stafford—Troubles of Electrical Equipment for 10 days' examination on approval. In 10 days I will send $3.00 plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

Name .....
Address .....
City and State .....
Position .....
Company .....EC-11-4

(Books sent on approval in U. S. and Canada only.)


## EQUIPMENT News

[FROM PAGE 124]

### Insulated Staple

This new Nail-It insulated staple will not bend, it is claimed by the manufacturer. It incorporates the dimensions of two sizes, the length of the No. 3 and the width of the No. 5. It is started by holding it at side of short leg and only long leg is driven in to start. After starting, wire can be passed underneath short leg. Insulated fibre is locked on staple so that it cannot fall off. Available in copper finish and in colors. Eagle Electric Mfg. Co., 59–79 Hall Street, Brooklyn, N. Y.

EAGLE INSULATED STAPLE

■

### Pulley Oiler

A visible, unbreakable loose pulley oiler for slow and high speed applications. It uses thermal, capillary and gravity action principles of operation. Copper tube transmits heat of pulley hub to oil reservoir to produce quick thermal action, wire reinforced wick feeds oil by capillary action and it is dropped on bearing by gravity. Available in one and two ounce capacities with ⅛- or ¼-in. pipe thread fittings. Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee, Wis.

TRICO OILER

■

### Multi-Outlet Systems

Two Plugmold multi-outlet systems are now available for domestic and commercial installations. Smaller No. 1900 has a capacity of 2 wires for single circuits. Large No. 2100 has a capacity of 6 wires for switch controlled circuits and where lumiline or fluorescent lighting is combined with outlet installations as under kitchen cabinets, etc. The Wiremold Company, Hartford, Conn.

WIREMOLD MULTI-OUTLET SYSTEM


**BADGER**

*Synchronous*

**ELECTRIC TIME SWITCHES**

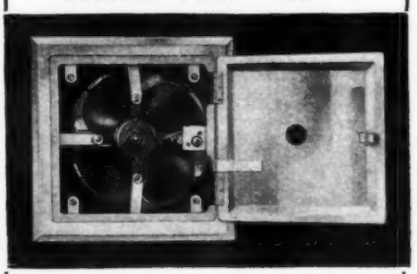
**CONTRACTORS LIKE THEM BECAUSE:**
they are dependable and easy to install

**USERS LIKE THEM BECAUSE:**
of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

**RELIANCE AUTOMATIC LIGHTING COMPANY**
**1937 MEAD STREET RACINE, WISCONSIN**

**EVERY KITCHEN NEEDS A SIGNAL VENT FAN—**



**Models to fit walls 6" to 30", with a list price for 110-Volt A.C. 60-cycle, for 6" to 11½" walls, $21.50, the automatic built-in type, shown above for permanent installation, is telescopic in design. Can be installed in new or old houses. Easy to install. 10" quiet type fan blades. Door operated switch. Totally enclosed motor. Automatic weather-tight shutters. Air displacement 650 C.F.M. Finish of inside section and door is white; fan is brown with polished aluminum shutter vanes. Write for details today.**

**SIGNAL ELECTRIC MFG. CO.**

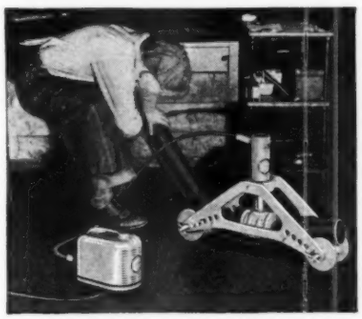
**Menominee, Michigan**

***Offices in principal cities***

SIGNAL

## Hydraulic Pump

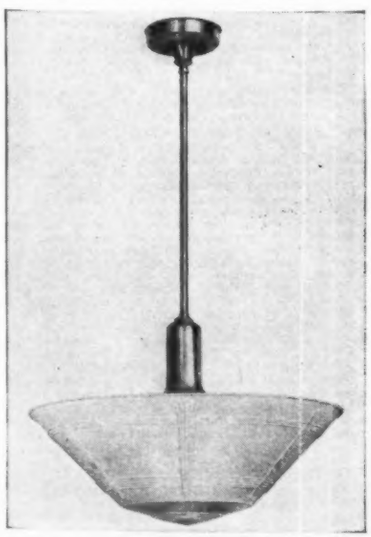
This motor-driven, portable, hydraulic pump delivers up to 50 tons power. Can be connected by high-pressure hose to any one of the "Porto-Power" rams, which have varying sizes and capacities of 4, 7, 10, 20 and 50 tons. The hydraulic units, with special attachments, are used for production and maintenance work involving pushing, pulling, pressing, bending, clamping, spreading and lifting operations. Pump can also be equipped with gauge for testing or weighing in "tons total load" or "pounds per square inch" pressure. Blackhawk Mfg. Co., Milwaukee, Wis.



BLACKHAWK HYDRAULIC PUMP

## Luminaire

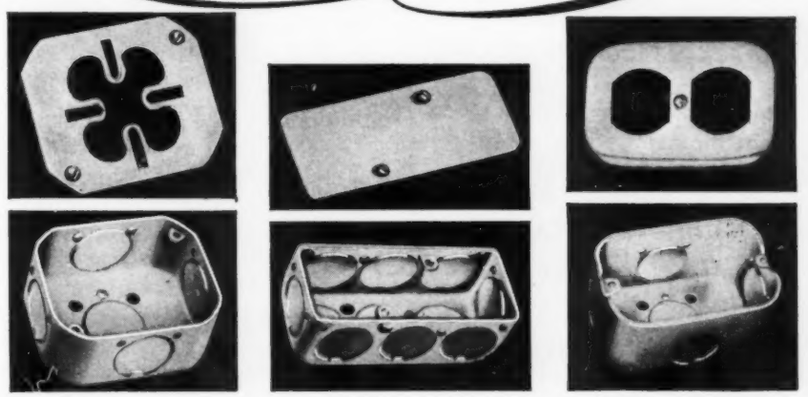
Semi-indirect luminaire, type PL-500, is designed for general illumination of commercial buildings, such as offices, banks, restaurants, stores and schools. Units available in 300-500 watt size only. Basin in translucent colorless ureaformaldehyde molded plastic to which a coloring pigment has been added to bring out a soft ivory shade. Light cut-off is variable, basin supports having two positions. Accessories include canopy switch, shield ring and if required, "Three-Lite" sockets are available. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE PLASTIC LUMINAIRE


# G-E MULTILETS

*The Conduit Boxes with a Thousand Uses*



**Shallow Multilet and Typical Cover**

Designed to accommodate surface-type wiring devices. Can also be used for same purposes as Branch Multilet.

**Branch Multilet and Typical Cover**

Designed for branches, junctions, pull work or extensions.

**Deep Multilet and Typical Cover**

Designed to accommodate flush-type wiring devices.

You can make endless combinations of conduit boxes right on the job with Multilets. The three boxes in the Multilet line plus two couplings and a few covers take the place of countless cast iron conduit boxes each designed for only one condition.

Multilets, formerly called Spraguelets, have been proving their worth for 20 years. You don't need a large stock of conduit boxes for interior work. Use Multilets in any one of a thousand ways for exposed wiring in rigid conduit or E.M.T., for concealed wiring, and for BX or flexible conduit wiring.

Multilets are ideal for both new work and for making changes and repairs. They may be attached rigidly to conduit with no other support necessary or they may be used as ordinary outlet boxes.

For further information about time-saving, stock-saving Multilets see the nearest G-E Merchandise Distributor or mail the coupon below.

General Electric Company
Section C-0121, Appliance and Merchandise Department
Bridgeport, Connecticut

Sirs: Please send me information on G-E Multilets.

*Name* .....

*Address* .....

*City* ..... *State* .....

GENERAL ELECTRIC

NEW

**MONARCH MON-O-LAG RENEWABLE FUSES**

for

**Better Protection**

and

**Low Fuse Maintenance Cost**

Stocks in twenty strategic locations throughout the country for wholesaler service

**MON-O-LAG FEATURE**

Prevents needless opening of circuits on harmless overload surges

**ULTRA MODERN**

in ruggedness, simplicity of construction, and ease of renewal

**MONARCH FUSE COMPANY, INC.**
Jamestown, N. Y.
1909 Established 1909

**20 AMPS! 2200 WATTS! $12.00!**

**THE NEW MODEL 120 AUTOMATIC TIME SWITCH**

For turning signs, window lights, lighted billboards, and so on, ON and OFF automatically. Will handle loads up to 2200 watts. Easy to install and simple to operate. Load can be turned ON or OFF at times not called for by Time Switch. Self-starting electric motor will operate at temperatures down to 40 degrees below zero. New features . . . New compact size . . . New opportunities for YOUR profit!

*Write for Information and Discounts*

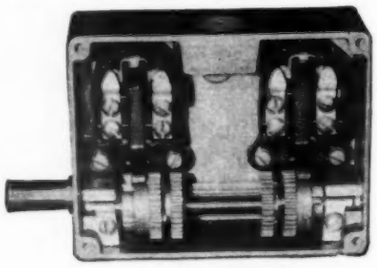
**AUTOMATIC ELECTRIC MANUFACTURING CO.**
Mankato, Minnesota

## EQUIPMENT News

[FROM PAGE 127]

### Limit Switch

A new, small-size geared-type limit switch has been developed for application on motor-driven devices, such as automatically operated window shades, automatically opened garage doors and certain types of machine tools. Switch is 4 11/16- by 3 1/4- by 1 13/32-inches. Contacts are designed for 125-volt, 4-ampere a.c. and 125-volt, 1-ampere d.c. operation. Some of the features are double-break, silver contacts which clean themselves with a rocking motion; mechanism easily adjusted to operate contacts and three holes in base to mount switch in any position desirable for attachment of shaft. General Electric Co., Schenectady, N. Y.



G-E LIMIT SWITCH

■

### Test Lamp

A new test lamp for testing electric circuits has been developed. It comes fitted for testing 110-volt and 220-volt circuits. Can be furnished with higher rated bulbs for similar testing and indication of higher voltage circuits. Consists of two small lamps screwed into molded plastic base and connected by 2-foot, insulated flexible lead wires to pointed contact prods, protected by 5-inch fibre handles. A transparent plastic hood screws over base, covering bulbs. Line Material Company, Milwaukee, Wis.

LINE MATERIAL TEST LAMP

# SEARCHLIGHT SECTION

*(Classified Advertising)*

## "OPPORTUNITIES"

UNDISPLAYED RATE

15 CENTS A WORD. MINIMUM CHARGE $3.00
*Positions Wanted* (full or part time salaried employment only), ½ the above rates payable in advance.
*Box Numbers*—Care of publication New York, Chicago or San Francisco offices count as 10 words.
*Discount of* 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

*Individual Spaces* with border rules for prominent display of advertisements.
The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
*An advertising inch* is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

## SELLING OPPORTUNITY WANTED

MANUFACTURERS' REPRESENTATIVE successfully covering metropolitan area New York City desires additional line. RA-16, Electrical Contracting, 330 W. 42nd St., New York, N. Y.

## LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Electrical Contracting, published monthly at Albany, N. Y., for October 1, 1940.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared D. C. McGraw, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Electrical Contracting, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Editor, Earl Whitehorne, 330 West 42nd St., N. Y. C. Managing Editor, None. Business Manager, W. K. Beard, Jr., 330 West 42nd St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw; Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 73 No. Country Club Drive, Phoenix, Ariz. J. Malcolm Muir & Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 140 Broadway, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

D. C. McGRAW, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 27th day of September, 1940.

[SEAL] H. E. BEIRNE,

Notary Public, Nassau County. Clk's No. 93. N. Y. Clk's No. 974, Reg. No. 2-B-609.
(My commission expires March 30, 1942)

# Maybe You're Missing Something

We've been out "hitting the road" lately to find out what benefits typical readers of Electrical Contracting are getting from the advertising. Here are a couple of sample benefits, culled from nearly 100 calls:

**NEW JERSEY CONTRACTOR**

*"I keep a file of advertisements on products which I think I'm likely to need. For instance, I had a job a while ago which required silver-plating of a lot of bus. Thought I'd have to tear all the bus down and send it out, but my ad file showed me a small silver-plating outfit which could be used on the job. I saved several hundred dollars through that advertisement."*

**LONG ISLAND PLANT ELECTRICIAN**

*"Read the ads? Sure! My job is to save this company money, and there are new products being developed every day to do just that. The advertising section is one of the best places to keep up on these new products."*

The advertising section has plenty of good, solid suggestions that can mean money in your pocket . . . . quicker installations . . . . greater efficiency . . . . better satisfied customers.

*It pays to read the advertisements in*

ELECTRICAL CONTRACTING


## Lighting Fixture

This fluorescent lighting fixture, equipped with louvers, is designed to eliminate "eye spot" or glare, and to evenly diffuse the lighting. Available for suspension or flush ceiling mounting. It uses 48-inch fluorescent lamps and comes in two, four or six lamp fixtures. R. & W. Wiley, Inc., Hertel at Elmood Ave., Buffalo, N. Y.

WILEY FLUORESCENT FIXTURE

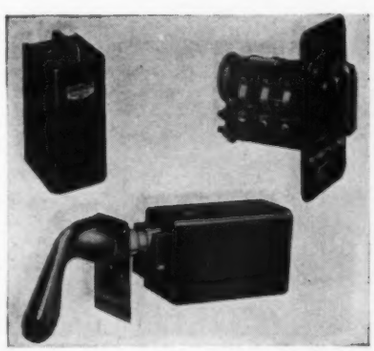
## Fixture Switch

A new fixture switch with an arrangement for attaching wire leads to terminals. It is small, compact and strong. Fits wall thickness up to $\frac{1}{16}$-in. and has 9-in. wire leads, stripped $\frac{3}{4}$-in. Overall dimensions, $\frac{3}{8}$-in. by $\frac{7}{8}$-in. Ratings are 3 amp., 125-volts; 1 amp., 250-volts. McGill Manufacturing Company, Valparaiso, Indiana.

McGILL FIXTURE SWITCH

## Switch

A new drum type master switch, providing 3-wire control for machine tools and other equipment has been developed, for use where an operating lever is preferred. Surface, cavity and panel mounting constructions are available and standard and pistol grip handles. By removing a stop post, drum may be converted from non-reversing to reversing. Ratings are for pilot circuits up to 600-volts a.c. and d.c. Cutler-Hammer, Inc., Milwaukee, Wis.



CUTLER-HAMMER MASTER SWITCH


**MINERALLAC HANGER**

Conduit $\frac{3}{8}$"—$2\frac{1}{2}$"
Cable to $2\frac{1}{8}$" (with Bushings)

Cadmium and Everdur
**MINERALLAC JIFFY CLIP**

Sizes from .250" O.D. Tubing to $1\frac{1}{4}$" conduit.

*See your Jobber*

New York City Office
Theodore B. Dally
50 Church Street

**MINERALLAC ELECTRIC CO.**
**25 N. Peoria St., CHICAGO**

**K&H Solderless Terminal LUGS** — A SIZE and TYPE for every need!

**PRESSURE TYPE CAST CLAMP TERMINAL LUG**

Noted for its simplicity, ease of application and adjustment.

Catalog Nos. 401 to 449

Wire sizes 1/0 to 2,000,000 CM. made in straights and angles for one or two holes for front or back connections.

**Write for Catalog 3LC**

**KRUEGER and HUDEPOHL**
232-8 Vine St.
CINCINNATI, OHIO

"A LIVE WIRE IS NO BETTER THAN ITS CONNECTIONS"

FOR FAST INSTALLATION and POSITIVE CONTACT.. USE

Sherman
Solderless Lugs

Type S-O
Heavy duty lug rigid and strong with extra contactarea

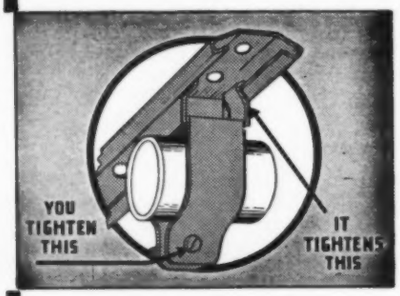
Type S-M
Low cost, one-piece lug. May be soldered if desired

Expertly designed, precision made, these Sherman Solderless Lugs have won wide popularity. They are easy to use. They made a permanent, tight contact. Fully interchangeable with standard soldering lugs. Write for samples.

H. B. Sherman Mfg. Co.
Battle Creek, Mich.

With Only One Screw to Tighten. . . .

THE CLEVELAND CONDUIT HANGER




Gives You a Quicker Easier Installation

"CONVINCE YOURSELF"
"Send for Circular Giving Full Details"

THE CLEVELAND SWITCHBOARD CO.
2927 E. 79 St. Cleveland, Ohio

## EQUIPMENT News

[FROM PAGE 129]

### Interval Timer

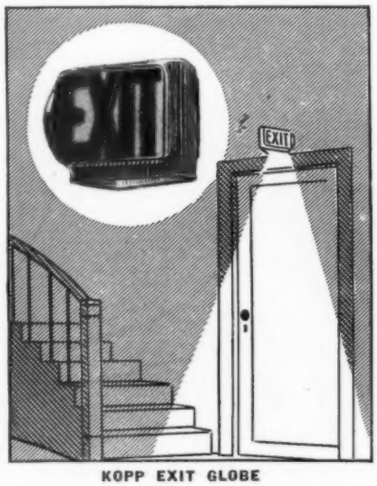
Electronic timer Type T15 is accurate over ranges from 1/20th of a second to two minutes. Has a specially designed snap-action relay of 1,000 watts capacity. Permits both momentary push button and sustaining contacts control. It is universal for six timing ranges represented by timing valves snapped into an accessible clip. Designed so that equipment is interchangeable. Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.

PHOTOSWITCH TIMER

■

### Exit Globe

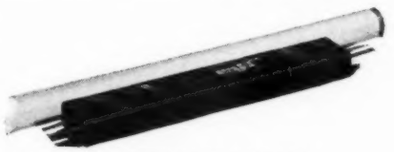
The bottom of this new exit globe is open and designed so as to throw a shaft of light on door or step below. Has word "Exit" imprinted on all sides. Available with either 3- or 4-inch letters on red, green or white glass and fits standard wall brackets. May also be adapted for marking elevators, washrooms and other places. Suitable for use in industrial plants, hospitals, theaters, schools, stores, office buildings, hotels, ships, institutions and other public places. Kopp Glass, Inc., 2233 Palmer St., Swissvale, Pa.




KOPP EXIT GLOBE

### Two-Lamp Ballast

A new two-lamp ballast, W2–43, has been developed for fluorescent lighting. Unit combines starting compensator and maintains high rate of efficiency. It measures 1 5/6-in. high and 2 5/32-in. wide and fits into restricted area of wiring channel. Core and coil assembly are vacuum impregnated with high dielectric varnish and cushioned against vibration with an "all-weather" insulating compound. Sola Electric Company, 2525 Clybourn Ave., Chicago, Ill.

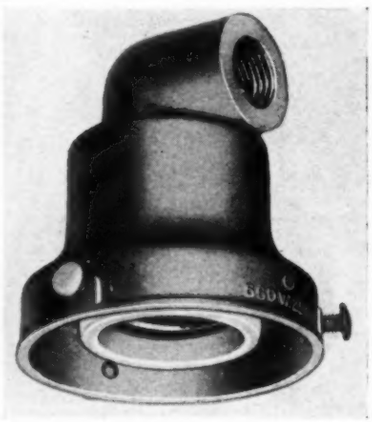


SOLA TWO-LAMP BALLAST

■

### Socket

These weatherproof sockets have cast enclosures and were designed for outdoor use. Two types (GE3329 and GE-3330) have straight enclosures with a $\frac{3}{8}$- and $\frac{1}{2}$-inch thread respectively, while another (GE3332) has a 90-degree enclosure with a $\frac{1}{2}$-inch-thread. All three are for industrial installations, as features include one-piece non-corrosive metal hood with shadeholder with permanent natural white metal finish, porcelain interior and set screw for tightening and support. General Electric Company, Bridgeport, Conn.



G-E SOCKET

■

### Selector Pack

Selector pack is a testing device for ascertaining capacity required on capacity motors. Pilot light indicates when switch of motor is thrown off. It has six toggle switches whereby serviceman can find the required capacity indicated on device. The range is from 15½ to 155½ MFD. Main line switch cuts off entire unit. Dumont Electric Co., 514 Broadway, New York, N. Y.

**SAVE YOURSELF TROUBLE**

In replacing broken sockets in Fluorescent Fixtures use the ALDEN RoToLoK Socket. Users can't go wrong in using them. Impossible to get prongs behind contacts or set up wedging strains that generally break other makes of sockets.

When ordering new fixtures specify

ALDEN
RoToLoK
FLUORESCENT SOCKETS
Patents Pending

Molded end of socket guides clamp prongs into the one simple opening—then the natural obvious twist locks the lamp in place. A reverse twist and the ejector latch gently raises lamp out of socket and locks rotor ready for next insertion—a feature especially desirable in showcase and out-of-sight fixtures.

*Send for complete story.*

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**Tests Everything Electrical From 100 to 550 Volts**

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.

Only Test-O-Lite, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in home also. List $1.50 at leading jobbers.

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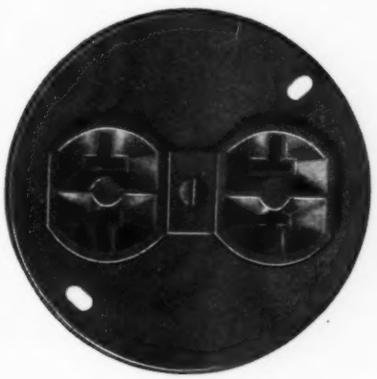
COPY NOV. 22 FOR DECEMBER ISSUE


## Switches and Outlets

The new G-E switches and convenience outlets mounted on brown molded box covers have been designed for surface wiring where an insulated cover is required. The line includes single-pole switches, rated at 10-amperes, 125-volts and at 5-amperes, 250-volts, mounted on 3½- and 4-inch covers. Similar switches with a 10 T ampere rating. Twin convenience outlets with parallel slots mounted on 3½-inch and 4-inch covers. Twin convenience outlets with double "T" slots mounted on 3½-inch and 4-inch covers. General Electric Company, Bridgeport, Conn.

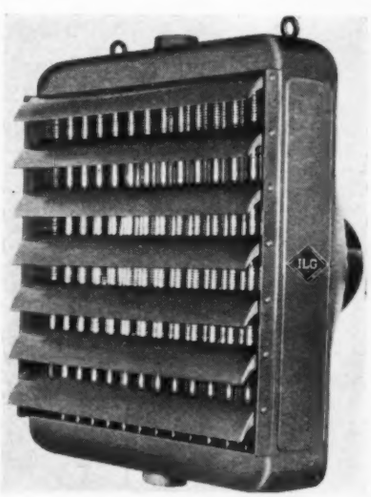


G-E TWIN OUTLET

■

## Unit Heater

A new unit heater called "Vital Zone" has been developed. It has fully-enclosed, self-cooled motor; two-piece header, similar to that used in high pressure boiler; heating coil made of copper; at the bottom, header "floats" on slotted coil retainer and spring washers to allow for expansion and contraction of the coil. It "shoots" the heated air from 40 to 80 feet, delivering from 385 to 6900 cu. ft. per minute, depending upon size of unit. Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.




ILG UNIT HEATER

Patent No. 2195154

***New Daylight Illumination***

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DIFFUSOLIERS definitely solve the problem of light distribution at maximum efficiency. Ceilings are lighted to a degree approximating the intensity of the light source resulting in ideal diffusion.

Write today for bulletin W and discounts.

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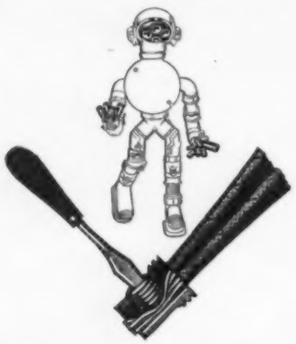

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(CAP MADE OF BAKELITE)

*. . . and a permanent one, too. Simply insert the wires, turn on bakelite cap, and tighten with the screw driver.*

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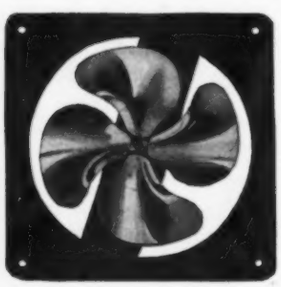
*SIGNAL 16-Inch VENTILATOR FAN*
*$16.50 List*



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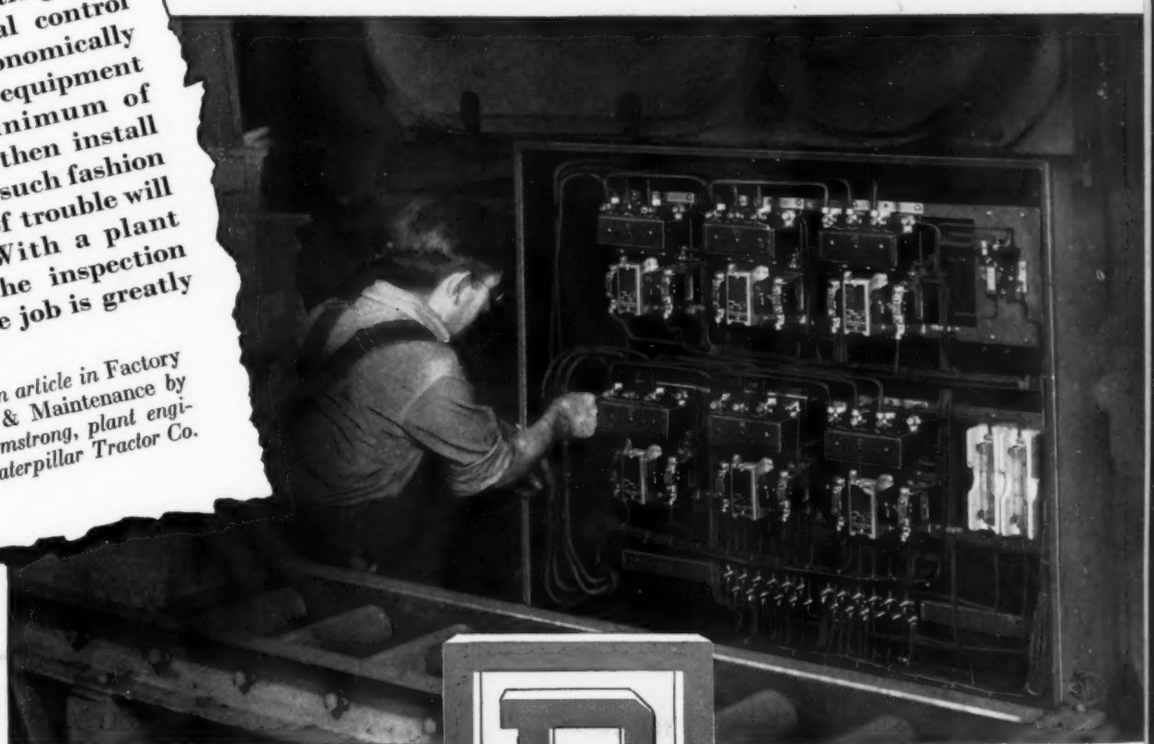
*—From an article in Factory Management & Maintenance by Mr. C. E. Armstrong, plant engineer of the Caterpillar Tractor Co.*



**At right: Photograph taken in the "Caterpillar" plant in Peoria, Illinois, showing efficient, convenient installation of Square D automatic starters.**

**● More and more electrical contractors are making a strong bid for industrial maintenance work. The more of this kind of work they do, the more they appreciate and value the advantages of Square D motor control.**

**Square D starters and controllers are easy to wire. Accessibility is a "must" in Square D designing. All renewable parts can be inspected or replaced with a minimum of time and labor. Contacts, springs and magnet coils can be removed from Square D starters without disturbing any of the line or load connections. All of which adds up to better, easier maintenance at lower cost.**

**Write for our new Bulletin 137 which gives detailed description of the complete Square D line of vertically-operating, automatic starters.**

**Notice the accessibility of all parts for inspection or replacement — a Square D feature which assures better, easier inspection and maintenance.**

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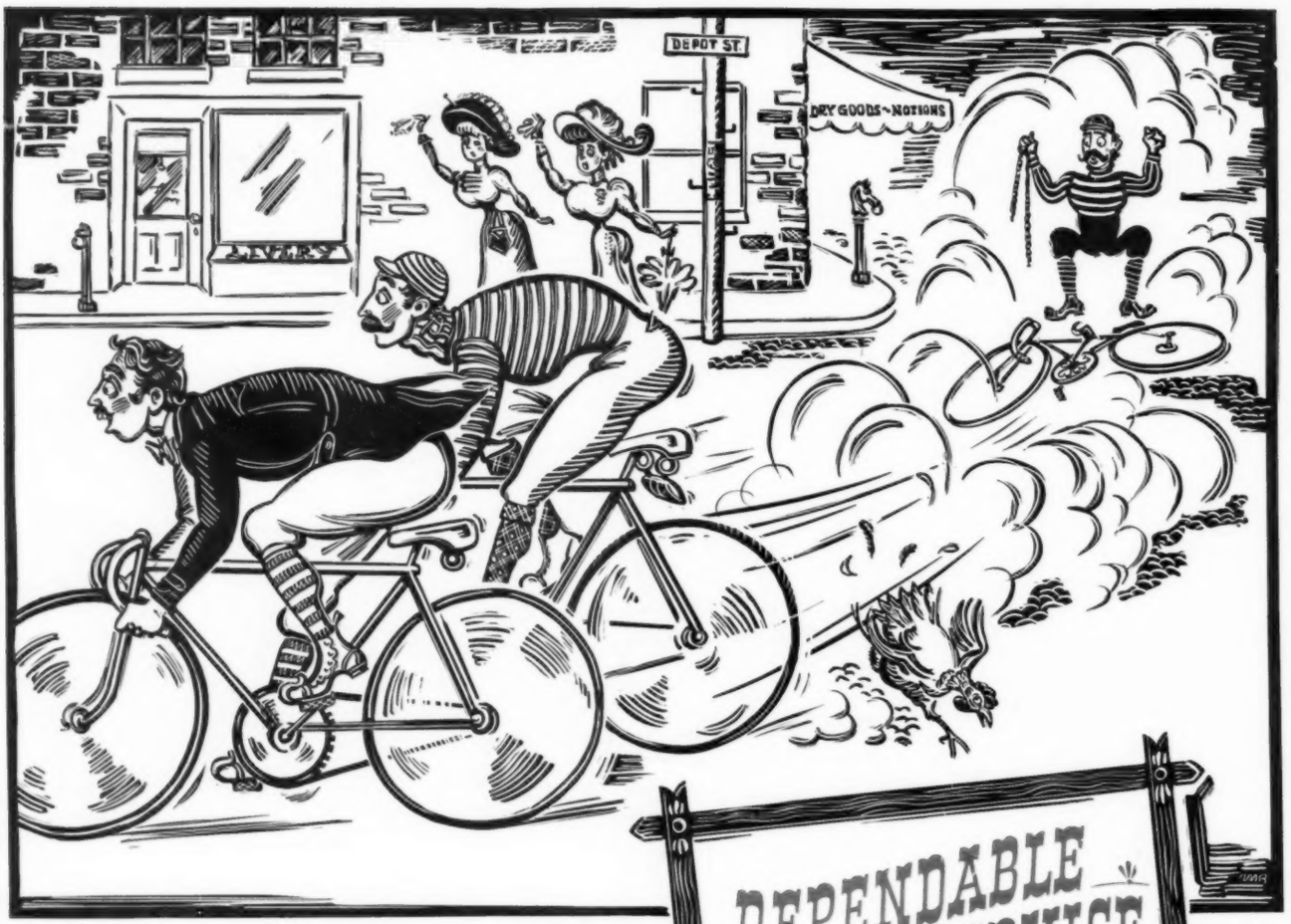
**SQUARE D COMPANY**

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO




In the hey-day of bicycle racing, chains were carefully chosen for dependable service. They transmitted power. No less careful selection of electrical wiring materials should be made today. Undependable wiring may cause severe production loss, inconvenience, and expensive repair work.

General Electric quality wiring materials can help to provide the dependable electrical service needed today in new factories, homes and other buildings. All phases of modern life depend upon electrical power. Therefore, durable, trouble-free electrical wiring is needed as it has never been needed before.

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For further information about G-E wiring materials or G-E Home Wiring see the nearest G-E Merchandise Distributor or write to Section CDW-0121, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn. for a G-E handbook on industrial wiring or residential wiring.

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